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'SYCHOLOGY AND THE DAY'S WORK

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PSYCHOLOGY AND THE DAY'S WORK

A STUDY IN THE
APPLICATION OF PSYCHOLOGY TO DAILY LIFE

BY
EDGAR JAMES SWIFT
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TO MY WIFE

WHOSE DEVOTED ASSISTANCE IN THE PREPARATION

OF THIS BOOK

HAS BEEN UNFLAGGING

PREFACE

PSYCHOLOGY considered as the science of human behavior is concerned with man's response to the impressions made upon him by objects, people, and events. They make up the situations that he meets. Behavior—the individual's way of dealing with these situations—if not a complete failure, results finally in some sort of adjustment to the conditions in which one lives; and this adjustment culminates in social and moral habits, in habits of work, in ways of thinking and acting; in short, in habits of life. And through all the adapting process runs the influence of physiological conditions, and the effect of their changes caused by the manner of life and the advance of years. The adjustment may be mechanical and rigid, insensible to misfits, without power to readjust as conditions alter; or, again, it may be flexible and adaptive—capable of new adjustments as circumstances change. This adjustment represents the capacity of man for achievement. It is his efficiency—the strategy and tactics of life.

It is well, then, from time to time to take an inventory of stock and try to discover the significance of the facts and principles of human behavior which investigation has revealed. A science is made no less scientific by applying its discoveries. The chemist and botanist are not concerned primarily with the practical application of the results of their work, yet industrial chemistry and economic botany are rendering incalculable service to related lines of business.

Psychologists have only recently extended their investigations into lines directly useful in explaining and interpreting behavior. Yet their contributions in several fields

of the world's work are already impressive. In psychopathology, in legal psychology, in experimental pedagogy, and in the psychology of advertising, they have made noteworthy additions to the store of knowledge; and to-day psychological tests are being made in the army to determine the fitness of men to do the work to which they aspire in the service of our country.

Concerning the more common matters of every-day life, however, psychologists have offered relatively little of interpretative value. Yet these experiences make up the day's work. They determine its quantity and quality. Much has been written about making others efficient, but comparatively little about one's own method of thinking, working, and acting. Yet knowing oneself reaches far into success and failure; and there is no other way of understanding the behavior of others. It is, therefore, in the hope of interpreting a few of these personal experiences of daily life that this book is written. The topics that could be discussed extend far beyond the limits of a single volume. The choice, of course, is largely personal, but the writer has tried to select types of conduct, as well as phases and causes of behavior, that are fundamental to thinking and acting, whether in the life of social intercourse or in the business and professional world. And after all, thinking and acting determine achievement.

EDGAR JAMES SWIFT.

WASHINGTON UNIVERSITY, ST. LOUIS, MO.,
September, 1918.

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CHAPTER I

ORGANIZATION FOR MENTAL EFFICIENCY

MAN'S response to situations in the day's work is the measure of his efficiency. When the response results in behavior which satisfies the immediate, pressing demands and, in addition, adapts itself to change, growth, and progress, efficiency is perfect. In other words, the ability of a man to react effectively to his daily problems may be gauged by his *alert, flexible adaptation to changing circumstances.* The other side of the shield, however, is more familiar—the sight of the person whose response to new conditions is unreflective adaptation influenced by the force of habit, and nothing more. We select an illustrative example from the many suggested by the present war.

"It did not seem possible that human beings could brave these haunted streets," says Owen Johnson,[1] speaking of Arras under bombardment; "and yet human beings were there. . . . In a broken street, where one shell had literally disembowelled a whole house, leaving only the roof hanging like a suspension bridge, whom should we happen upon but a postman delivering mail to a woman who rose cautiously from her cave. Remember, this was within fifty yards from the house which had been literally blown away. She was a sweet-faced old lady, untroubled and resigned. I asked the invariable question:

"'How do you dare stay here?'

"'Where would I go?' she said, with a helpless little look.

"To her, as to the rest, to leave home meant the end of all things. The outer world was something uncompre-

[1] *The Spirit of France*, pp. 103 *f.*

hended, which terrified her. The military authorities have done everything possible to enforce the evacuation of Arras, short of an absolute order, and yet they are met at every turn with this terrified clinging to the threshold, that prefers any risk rather than exile."

Adaptation and habit—adaptation to terrifying conditions, and the ability of the individual to continue his normal, habitual reactions in horribly abnormal situations! The nervous system cannot long continue to respond to repeated shocks. Either it becomes inured to the frequent mental concussions, which finally lose their power and cease to produce a response, or the nervous system gives way under the strain. Those who could not adapt themselves to the awful conditions had left or become insane. It is rapid and inexorable selection in which the sight of dead and maimed friends and the constant prospect of sharing their fate are the tests of even temporary survival. Adapt themselves they must if they remain; but, fortunately, the nervous system cares for that.

Another instance of adaptation—a more common, everyday illustration—is related by S. S. McClure from his editorial experience. "In the winter of 1905–1906 the Chicago papers were filled day by day with news that revealed Chicago as a semibarbarous community in which life and property were unsafe to an extraordinary degree. This daily crop of news would be duly accented by reports of horrible crimes. I had a selection made from these papers which gave a criminal record of Chicago for the winter and revealed an appalling situation. Now it is a fact, which I have observed, that people will become accustomed to almost any environment. I remember, when I was in Turkey, where occasionally a village would be devastated, the children killed and women tortured, that people in an adjacent village, who might at any time become victims, went about their work quite calmly and indifferently; so that it is not surprising that this daily grist of news of

the Chicago crimes was accepted by the citizens as a matter of course."[1] What is the explanation of these adaptations which lead, at times, to such incredible acquiescence?

All variation by which an individual or a species is adjusted to the surrounding conditions must be made by the organism. To be sure, fitness for types of variations must exist in the environment. Lung-breathing animals, for example, could not have arisen had it not been for the atmosphere which surrounds the earth, and adaptation to electricity could not have been made were it not for the prevalence of electrical energy. Had the earth and atmosphere, with all the kinds of energy manifested in or through them, been different from what they are, living creatures, if they could have existed at all, would bear little or no resemblance to present forms.

Within the limits set by the physical environment, however, great variation is possible. It is entirely conceivable, for instance, that an air-breathing mechanism quite different from the lungs might have developed. What, then, determines the kind and range of variation? For the lower animals it is natural selection acting through structural changes and instincts. Animals must adjust themselves to conditions as they are. Such moderate alterations of the environment as the damming of a stream by beavers are, of course, observed; but these instances of control are sufficiently rare to be commented upon by zoölogists. Usually animals must adapt themselves to a rigid environment, or perish.

Adaptation is perhaps the most significant influence to which organisms are subjected. The character of the surroundings, so far as conformity conditions their life, forms a circle within which the organisms live. In the unicellular animals the circle is small. The essential nature of their habitat has altered little even through the ages. Conse-

[1] *McClure's Magazine*, May, 1914.

quently, these simple animals have undergone little change. Their surroundings have put upon them few new requirements which called for adaptive reconstruction.

The history of animals from the lowest to man reveals continuous, though more or less interrupted, changes, resulting from the attempt to maintain harmonious relations between the organism and its environment. A certain equilibrium must be established between external forces acting upon the individual and his responses. Maintaining this equilibrium is what is meant by adaptation. Among the lower animals we have seen that strict conformity is the rule. Any change that takes place is forced upon them by the exigencies of their surrounding conditions. Few reconstruct their environment to any great extent before adapting themselves to it, and any reconstruction that they make is explained by some earlier adjustment which has become fixed in them as an instinct.

Man, on the other hand, because of the superior development of his brain, possesses greatly increased ability to alter his environment. In certain lines he has practically made over the world in which he lives. The changes growing out of the natural sciences have been stupendous, but in many other matters his "thinking" has been largely drifting. It is the same sort of involuntary, uncontrolled adaptation that is characteristic of the lower animals; and the reasons for this are the pressing demands for immediate adjustment which is as much a human as an animal requirement, and the fact that reconstruction of the environment to enable the adaptation to be more intelligent calls for an expenditure of energy which man is loath to meet. Now efficiency requires that the quantity of intelligence in human adaptations be increased. But let us see how adaptation works out in the actual affairs of life.

When a young man starts on his business or professional career he is at once confronted with certain obstacles—difficulties to be overcome. If he is a lawyer the obstacle

may be the unwillingness of a witness to reveal facts with which he is familiar. Now there are different ways of approaching a witness, and one acquainted with human personalities knows that certain methods are successful in dealing with some men and worthless with others. It is almost certain, however, that the young attorney will adopt a method that expresses his own personality rather than that of the witness. In other words, *his attitude and manner of questioning will be an unconscious adaptation to the difficulties that arise.* Soon this form of behavior toward witnesses becomes an established adaptation. This is shown by the fact that lawyers are often described as relentlessly severe or as gentle and insinuating, leading the witness kindly to unforeseen admissions.

If we say that we know when we succeed in what we are engaged upon, the statement must be qualified by adding that the standard of achievement may be low. Many college students, for instance, "succeed" if they obtain the "gentleman's grade" of mediocrity. For them it is sufficient to have just missed the lowest passing mark. A certain summer school, to illustrate further, celebrated an increase of twenty-five students over the preceding year. Yet the surrounding territory should furnish two or three times as many students as the school ever had. And, again, a salesman recently said with great elation that his sales for the year exceeded those of a fellow traveller whose record, the writer happened to know, was in the lowest third of those made by the salesmen in the organization. Since this relative success is the selective force in determining the adaptations it is clear that the result may be altogether inadequate to the needs and possibilities of the situation. There is, however, a further fact of immense importance to adaptation. The human environment is not static. "There is no standing still in the business world to-day," said the president of a large manufacturing plant recently. "Everything is in continual change, so

that a man no sooner adapts himself to one set of conditions than he must readapt himself to others. Those who cannot do so fall behind the more versatile. One of the largest manufacturers of engines failed to grasp the significance of the steam-turbine. The management sat still while other companies brought it to a successful commercial basis."

Methods of doing the day's work also bring their problems of organization and co-ordination. There is an enormous amount of overlapping of duties and responsibilities. A large furniture manufactory spent several days trying to determine the responsibility for failure to do a given piece of work satisfactorily and promptly. Each department concerned blamed another, and in the end no one was satisfied. Such inefficiency produces continual financial loss and frequent dissatisfaction both within the organization and with customers.

Success in business, as in other matters, requires that conflicts be adjusted and difficulties overcome. Now the solution may be delayed until the problem is thought out. Then the several ways that suggest themselves may be thought through so as to determine how they would work out in practice. Again, one of the more promising solutions may be put to the actual test of a preliminary trial to determine what errors had been overlooked. As a matter of fact, however, a man commonly uses neither of these methods. The idea in mind is the somewhat general notion of success, and the first method that seems to meet the exigencies of the situation is usually adopted. But the exigencies that are met are the immediate ones, those that are pressing for solution at the moment. The result is that the more remote, related conflicts are not adjusted. This was the case in the overlapping of responsibilities in the furniture factory to which we have referred.

When we ask what determines the selection of the plan or method of meeting difficulties that arise in business or

in the professions, we come upon an important fact in human psychology. The obstacle that confronts us must be overcome, and the method employed is commonly the first one that promises to attain the desired result. The situation is urgent and there is always a tendency to meet it with an economical use of energy. This frugality of energy does not indicate intentional slighting of difficulties. It is a phase of unreflective adaptation to them. In the acquisition of skill, where we shall see it playing a leading rôle, this adaptation is so strictly unconscious that the learner is not aware of the particular method which he has adopted for meeting a difficulty until he finds himself using it with more or less success.

Now it is significant for efficiency that the method unconsciously adopted, in the unreflective adaptation of which we have been speaking, is not always the best. Out of six young men learning the juggler's feat of tossing two balls into the air, catching and tossing one before the other reached the hand, the writer found that only two adopted successful devices for avoiding "collisions" in the air, which was the difficulty they were trying to meet. The other four used methods which soon ended in failure. All six found themselves employing devices before they were aware of the attempt. The plan unconsciously adopted to meet an emergency, in acts of skill, is usually the one requiring the least expenditure of energy. A very small matter may be the determining cause. Unselected actions follow the line of least resistance. So a business man attends to a matter of detail. It must be done at once, as it is an integral part of what he is engaged upon. To explain the matter to a clerk would require more time and energy at the moment than to do it himself. Consequently, he attends to the matter, and soon attention to details has become a habit. This adaptation is quite as unconscious as those which have been noted in acts of muscular skill. In both cases they are attempts to meet

quickly an emergency, and the most available method—the easiest at the moment—is unconsciously employed.

This mode of overcoming obstacles is the "trial-and-error" method. The term was first used to designate the manner in which animals attack a problem. They do not stop to think the matter over, but go right at it, trying one way after another in rapid succession until they either obtain the desired result or become discouraged and stop. The means which they employ are determined by specific inheritance or individual experience. If a dog, for example, within an enclosure sees food he will probably first stick his head between the bars; next he is likely to jump up and paw the bars; then he does something else until he finally hits upon the right combination for getting out and obtaining the meat. Afterward, by degrees, the useless actions are eliminated,[1] and the dog performs only those acts necessary to secure the food.

It is commonly assumed that there is a sharp distinction in this respect between the actions of animals and man. The one does not reason, it is said, and the other does. As a matter of fact, man does not reason as much as he thinks he does. Perhaps this explains why he calls himself a reasoning animal. He reasons so seldom that he likes to call attention to the little that he does. Children, for example, in learning to write use the trial-and-error method in determining the posture of the body and the movements in the writing. Of course it is used unconsciously, as in the other instances of which we have spoken. This is always the case in unreflective—unconscious—adaptation. The finger movement is the quickest way of getting results, and since it attains the desired end passably well, it is used unless the teacher is insistent. That the arm movement in the long run is less fatiguing and produces a better writer does not avail unless the beginner

[1] For a full treatment of this subject, see *Behavior*, by John B. Watson, pp. 256 *ff.*

is held rigidly to instructions. In children and adults alike, if the first method meets the difficulty fairly well, it is likely to be adopted without further search for a better way. This is the explanation of slovenly habits in acts of skill, in language, literary style, and in other things. But it goes further than this.

Unreflective—unconscious—adaptation was the method of progress during the early history of the race. Problems were not foreseen. There was no outlook beyond immediate needs. Difficulties were met by the simplest possible adjustment, and the environment was the compelling, directing force. It was the trial-and-error method, without interpretation, without clarifying judgment. Through long years some working principles were acquired, but they were gained at an enormous cost of time and life, and the final result was, at best, an approximate and temporary makeshift. Learning the curative qualities of roots and herbs is an example of the method and of the value of the knowledge gained by it. Indeed, this way of making progress under the influence of prevailing beliefs and conditions, as well as the adjustment of knowledge and method to them, is admirably illustrated by the entire history of the art of medicine which preceded the scientific period.

Systems of medicine—if the philosophical and religious view of diseases and their cures may be so dignified—followed one another as philosophy and religion changed.[1] Medicine, like other beliefs, rested on authority. Systems were respectable or disreputable. Massaria, of Padua, in the sixteenth century, would rather be wrong with Galen than right with any other physician. One system was used until another was thought to be better, though at that time the trial-and-error judgment was guided more by the underlying philosophical belief than by the results

[1] *Superstition in Medicine*, by Hugo Magnus, 1908. *The Relation of Medicine to Philosophy*, by R. O. Moon, 1909.

of the treatment. It could not be otherwise, since accurate records were not kept. One uncriticised authority ruled until superseded by another. But through it all the importance of finding the *cause* of diseases was unrecognized. There was no problem here. The mind, then as now, played its rôle in cures, and so we have *Three Thousand Years of Mental Healing*.[1]

Naturally in the past no other method of progress than that of uncriticised trial and error could be expected. The scientific method of investigation and experimentation was unknown. Consequently, there was nothing to stimulate thought. Besides, thinking has never been popular. It is too difficult. So any means of escaping from it has always been welcome. And when, as in the earlier days, besides the pains natural to originality, the thinker risked his life, new ideas were rarely made secure until the old had been worn out by the corroding effect of time. In the past this had its justification, but in the present it is without excuse. Out of a long period of progress by unconscious trial and error some truths emerge, but they are secured at an enormous cost of time and suffering. Blind trial and error is the animal and racial way. Unfortunately, it continues to be the chief method of modern man. Unreflective adaptation is followed to-day when obstacles are not so overwhelming as to force deliberation.

Man rarely stops to think out the method of procedure unless the difficulty is so great that no plan of action immediately presents itself. A momentarily insoluble problem is needed to make him think. But this is not all that is necessary. There must not only be a problem, but the individual must see it. The common supposition that problems are recognized is an error. Usually they pass unnoticed. If an illustration of so obvious a fact of human behavior is needed, advertising is a case in point. Thousands of dollars are spent for newspaper, street-car, and

[1] By George B. Cutten, 1911.

outdoor bulletin advertising without any intelligent effort to estimate the comparative value. To be sure, sales in a given advertised district are sometimes checked but there are too many local factors involved to give these estimates general value. Principles of advertising cannot be deduced in this way. These judgments have about as much value as the beliefs in the performances of so-called "psychics," such as foreseeing the future, mental telepathy, and the oracular nature of the writings of the ouija-board, which are still accepted on imperfect experiential evidence by the old women of both sexes. Again, the comparative cost per reader of full, half, and quarter page newspaper and magazine insertions is rarely known to business men. Yet these facts, and many more, may be ascertained by those who understand the method of scientific investigation. Some of them have already been worked out by psychologists. Business men do not have the information because they have not yet become aware of the problem. They are using the slow, expensive, uncriticised trial-and-error method.

The trial-and-error method is not without results. It is the means, as we have said, by which the experience of the race has been achieved. Knowledge has been slowly and painfully accumulated by the unplanned elimination of errors, but when uncriticised it is a wasteful process. The amazing advance of the natural sciences during the last quarter of a century is due to a new plan of campaign. Scientists no longer wait for the tedious, unintelligent elimination of mistakes. They set definite problems, study the conditions, and then plan their investigation so that the errors of earlier workers may be eliminated. This puts intelligence into nature's unintelligent method of progress. But the scientific plan has not been generally adopted. Usually man, like the lower animals, waits for something to turn up. Then he adapts himself as best he can.

Animals, we have observed, are dependent upon conditions that were forced upon them. To these they must adapt themselves or perish. But man can foresee and plan, if he will but use his intelligence. And by his planning he may reconstruct the environment. The world has been amazed at the success of German arms against a large part of the civilized world. The explanation is that the Germans looked ahead and planned. And in their planning they created conditions which the Allies have had to meet. We have heard much about time being on the side of the Allies. This means that they could not at once adapt themselves to the new type of war; and these new conditions were produced by Germany. Her military staff saw the problems and made their arrangements so completely that the adaptation had to come largely from her enemies. Many of the plans of the Allies were rendered obsolete by her constructive military thought. Forts were demolished like paper houses, and entirely new implements of war had to be invented and made. It is doubtful whether we shall ever have a better illustration of man's control over the conditions he must meet than this present war.

In industry, in commerce, and in military science Germany has risen above the animal method of unplanned adaptation, but in her failure to understand the collective mind of her enemies she has remained on the lower level. For her statesmen there existed no such problem. One of the many interesting psychological facts of the present war is the surprise of the German nation that the Allies do not know when they are whipped. The first magnificent Russian drive, followed immediately by the equally convincing Balkan victory, should have brought a request for peace from a purely military standpoint, which does not take into account different sorts of minds. And, again, the inability of the United States to recognize the righteousness of the German cause was to be explained, the Ger-

mans thought, only by generous use of British gold and the mercenary nature of the people. But the Germans missed the point. Their ignorance of the psychology of other nations is one of the astonishing disclosures of this war. "They understand nothing of the spirit of man," as Mr. Britling said.

The array of psychological blunders of the German military and civic authorities, to carry the illustration further, is unequalled in modern history. To mention only a few, there was first the invasion of Belgium, and the scrap-of-paper episode, which brought England into the war and shocked the civilized world. Then followed the sinking of the *Lusitania*, the execution of Edith Cavell and Captain Fryatt, the barbaric deportation of Belgians, the slaughter of women and children by air raids on unfortified towns, the Zimmermann note urging Mexico and Japan to make war on the United States, the secret proposal through neutral Sweden to promise protection to Argentine ships, and then to sink them "without a trace," the submarine perfidy that made the United States an active enemy, the planting of disease germs in Roumania, and the aerial bombardment of hospitals, by which wounded soldiers and nurses were killed—hideous exhibitions of brutality. No efficiency was disclosed by these acts; they reveal only amazing incapacity to understand the spirit and sentiments of civilized peoples. If these acts were not always unplanned adjustment to the supposed needs of the moment, they certainly show unintelligent adaptation. Was military necessity the motive? If so, their efficiency is arguable. But surely, sinking the *Lusitania*, the execution of Edith Cavell and Captain Fryatt, murdering from the air innocent women and children, and bombing hospitals have not advanced the German armies. It is gross, inexcusable incompetency; and the massed psychological blunders have sealed Germany's fate. Is it asking too much to expect a nation to be efficient in various lines? Probably na-

tional ability, like that of individuals, is specific and not general; then it is attained only in those fields to which serious study and thought are given. At all events, the German belief regarding the behavior of civilized nations toward her barbarous acts grew out of uncriticised experience—the animal method. And the acceptance of uncriticised experience is adaptation to events as they come to us.

Experience is a filing-case from which a man draws reports from his past life. And the analogy goes further. He selects from the files that for which he is looking. If one wants to believe something one will find ample justification in one's memory records. A significant psychological corollary is that another man with essentially the same "experience" will draw the opposite conclusion. In discussing questions of efficiency with business men the writer has found them differing vitally regarding matters of policy about which they should have agreed did "experience" have objective validity. The disagreement was not in the facts but in the interpretation of them and in the attitude toward them. This last is important because the mental attitude ends by altering the facts themselves. If a man expects a plan to succeed the chances are that he will carry it through, and if one anticipates failure one is quite certain to be gratified. Unbelievers are often surprised at the experiences of followers of occult phenomena. The explanation is, of course, that believers see, hear, and feel what they are expecting. "Do you never have the feeling of having previously existed in another form?" a theosophical devotee once said to the writer. To the reply, "Never, madam," came the astonished exclamation, "That is strange! I often do!" Prophecies, again, fulfil themselves for their advocates. Believers in the miraculous cures by relics or mind produce the cure—if there is nothing serious the matter—by their belief. Primitive man, who was convinced that injury to his clay image would cause his death, fulfilled his fate because he lost his

nerve; and, in more recent times, Charles Kingsley, speaking through Mr. Leigh, says: "I have seen, and especially when I was in Italy, omens and prophecies before now beget their own fulfilments, by driving men into recklessness and making them run headlong upon the very ruin that they fancied was running upon them."[1] "Where there's a will there's a way" may not always be true, but it is a good mental attitude to bring the desired result. No one who did not believe in ghosts ever saw one, and visible spirits vanished with the coming of science, except in groups where science has not yet penetrated. The new knowledge that attends scientific investigation alters experience.

Experience is evidently a treacherous guide because it is likely to give what one is seeking. "I have tried putting children on their honor and letting them govern themselves, but it has failed," said a teacher recently. Of course it did. He expected failure and arranged the details so that it had to fail. Another teacher replied that he had used the plan for ten years and could not get along without it. This confidence was the reason for his success. The Colorado penitentiary system which has transformed the prison and made the roads of the State would fail under a less enthusiastic believer than Warden Tynan.

The trouble is not with experience but with the experiencer. He gets what he is looking for and so does not question the result. A variety of meanings may be observed in most experiences, and the one selected is likely to be taken either from unwillingness to undergo the effort of thinking or from emotional bias, which, again, is favored by native indolence. Spiritualistic materialization illustrates uncriticised, submissive adaptation from the side of perception. One medium has said that whenever she gives a séance, the stories told afterward grow, and always to her advantage. They grow so that when they come back to her she can hardly recognize her own work. "It

[1] *Westward Ho!*

is a fact," she says, "that believers are so anxious for tests that they always help out, if they be believers, in the way that the medium desires they should." [1] This is because the mediums' desires coincide with the wishes of their followers. It is a common experience of lecturers to find an address interpreted in quite contradictory ways by different hearers who read their own views into what was said. A friend has told the writer that he recently gave an address on mind-cures. The lecture was purely descriptive, giving the positions and beliefs of the several "schools." At the close of his address a New Thought advocate, a metaphysical healer, and a Christian Scientist went to the platform to express their pleasure at finding him in their ranks. Yet, so far as he expressed any opinion at all, his intention had been to show that suggestion was the common factor and operating cause in all mind-cures. Here, again, adaptation—accepting appearances and adjusting oneself to them—was perfect, but comprehension was negligible.

Another instance of adaptation is the acceptance of succession of events as indicating cause and effect. Shortly after McKinley's first election to the presidency of the United States, potatoes, which had been low, rose to over a dollar a bushel, an advance which was attributed by Wisconsin farmers to his election. The fact that a potato famine occurred, owing to continued droughts in wide potato areas, was ignored.

Coincidences—agreement between events with wholly different causes or conditions, which, accordingly, are not likely to agree again—are often the basis of judgments and opinions, and adaptation is then made to their face value. Coincidence is the explanation of the importance ascribed to numbers by the ancients. Sometimes the coincidence is astonishingly striking. "If to 1794," for instance, "the number of the year in which Robespierre fell, we add the sum of its digits, the result is 1815, the

[1] *Behind the Scenes with Mediums*, by David P. Abbott, 1912, p. 67.

year in which Napoleon fell; the repetition of the process gives 1830, the year in which Charles the Tenth abdicated. Again, the French Chamber of Deputies, in 1830, consisted of 402 members, of whom 221 formed the party called 'La queue de Robespierre,' while the remainder, 181 in number, were named 'Les honnêtes gens.' If we give to each letter a numerical value corresponding to its place in the alphabet, it will be found that the sum of the values of the letters in each name exactly indicates the number of the party." [1]

Teachers of psychology are frequently regaled with coincidences seriously offered as "proof" of something that those who relate the stories want to believe. They are the basis of much of the evidence for "reasoning" in animals, and it is probable that not a little of the circumstantial evidence in criminal courts has no better foundation. The success of advertising campaigns, again, may frequently be traced to the same chance agreement of events.

Animals low in the scale accept appearances. To them the world is what it seems to be. They are troubled neither by philosophic nor scientific doubts. They could not do otherwise and survive. If fishes stopped to examine a worm or a fly before seizing it they would starve to death. It is better that they take their chances. Appearances are true to fact often enough to meet their purposes. There are only a few things for which animals must provide—chiefly food and self-protection — and nature remedies their mistakes by rapid and numerous multiplication. The herring lays twenty thousand eggs, and the conger-eel the enormous number of fifteen million annually. It is more economical for nature to provide against annihilation in this lavish way than to make all animals clever. But, as we ascend the animal series intelligence begins to count, and then the offspring are not so numerous. The

[1] *Principles of Science*, by W. Stanley Jevons, 1900, p. 263.

higher forms have better developed sense-organs, and they interpret more correctly the world in which they live. To them appearances may be deceitful. Foxes are famous for the skill with which they circumvent animals and man, when seeking food or escaping from enemies. In the arctic region they dig down through the snow under the trap, so as to spring it, and then they carry away the bait. The life of both parents and young is now important, because the offspring are not so numerous. Nature is not so extravagant in producing them. So they must be protected by cleverness if a given species is to survive. Far down the animal scale mechanical reactions are the only defense but among the higher forms intelligence has a greater value in nature's market, and in man survival depends only in a slight degree upon physical strength, at least beyond that which is needed to do his work. Intelligence is now the compelling factor.

Man, however, has not developed a method of progress. He does not make it his business to criticise experience. Like the lower animals, he is prone to accept appearances as true to fact. In other words, he continues to use the animal method. To be sure, scientists, as we have said, have a method. They prepare an experiment so as to control conditions, and they eliminate one factor after another that the effect of each in the phenomenon under investigation may be determined. This is man's reconstruction of nature's trial-and-error method, but it is too slow and laborious to satisfy the unscientific. These people want immediate results. So they draw conclusions from limited and uncontrolled observations, and take much pride in what "experience" has taught them. The complacency of "self-made" men in their "experience" is well known. They have taken a heavy responsibility from their teachers and from the Almighty with their boast of being self-made. To be sure, some effort is being made to-day to test experience in matters outside of science.

Scientific management is an attempt to introduce an intelligent plan into industry, but it has been only hesitatingly admitted into factories, and the doors of other lines of business are still generally closed to it. "Efficiency experts," however, are commonly men who have had much experience in the business which they criticise, but little scientific training. Some of them do not know what an investigation means or how a problem looks. Few have studied psychology, which, for those who are dealing with human behavior, is of fundamental importance in determining efficiency tests and plans. In municipal and governmental affairs, again, scientific management is only occasionally employed. Penology is still an awful chaos, and sociology an array of interesting but confused facts. In these matters, as in other things, "experience" is thought to be of only one sort, always yielding valuable knowledge.

Experience, of course, organizes itself. But this organization tends to proceed in the same unintelligent way that has been found to be characteristic of the organization of movements in learning an act of skill. In both cases the line of least resistance is followed. Personal bias and emotional preference play a leading part in the product of experience. Men are still much like those of old who refused to look through Galileo's telescope at the satellites of Jupiter because, as they said, the satellites were not there, but if they looked the devil would make them see them. Facts should be so classified that their bearing upon one another or their lack of connection may become clear. In this way the essential is distinguished from the unessential or accidental. This requires a wide knowledge not only in the business in which one is engaged, but also in related subjects. And for those who deal with human beings, and few occupations are not concerned with them, the science of human behavior—psychology—is needed. Unorganized facts, observation, or experience give, at best, only the "big, blooming, buzzing confusion" of which

James spoke. Many are not sufficiently sensitive to feel the confusion. They let experience go its own way and organize itself, like the Oxford theologians who were excited to violent antagonism at the production, by Faraday and others, of induced currents of electricity in a coil of wire by means of a magnet. Keble, also, professor of poetry in Oxford, was angry at the university because, as he said, it "had truckled sadly to the spirit of the times" in honoring these "hodgepodge philosophers." The experience of these professors had been too limited, too undisturbed to make them efficient in the world's problems.

An uneventful environment means mental stagnation. With nothing to compel selective action comes dulness, then in time retrogression. Progress, improvement, requires resistance—something to work against. This is not without significance in the training of children. The time comes when boys should have something dangerous to do, something that requires strenuous effort, thought and courage, real adventure involving, in their mind at least, danger. If such adventures are not provided they will find them for themselves, if they have the stuff that makes for vigorous manhood. This is their way of reconstructing their environment, of selecting and making the situations to which they will adapt themselves; and it is quite comparable to the creations of engineers and men of "big business." If boys do not find adventures when they are not furnished them, if they adapt themselves to the colorless, uneventful life of the "well-behaved" boy, their childhood has been deprived of something as essential to mental growth as the hormones—"chemical messengers" —are to physical development.

This need of courage in risk and adventure is as true of races as of individuals. The best period of a people, the period when they are doing things that are worth recording in their history, is their years of struggle, struggle against nature and against human adversaries. This is

seen in the Roman republic and Grecian democracy. It is also observable in the rise and progress of religions, and it is equally true of individuals. Whatever truth there is in the accomplishments of self-made men lies in the fact that they had to fight against adverse conditions. Those who succeeded had staying qualities, perseverance, and the determination to win. Opposition, adverse circumstances, do not put brains into men, but they draw out what there is in them. Obstacles also eliminate incapables. And the reason why the sons of self-made men so rarely show the qualities of their fathers is that they are protected. The fathers supply them with money and automobiles, and "carry" them in business. The brain, like muscle, must work against resistance if it is to develop. Of course obstacles should not be beyond the available strength. Peoples sometimes succumb after brilliant efforts because the call was beyond their capacity, though sometimes by the psychological law of compensation their failure to maintain themselves as a nation may lead to success in literature, art, or science. But this does not necessarily mean that the losing battle which they valiantly fought was without significance. The quality of resistance, insufficient in battles and politics, was transferred to other fields. The need to fight developed staying qualities. In other cases, enervated by acquiescence and luxury, peoples have yielded to debilitating tendencies, and gone the way of the inefficient. Peoples and individuals are by nature indolent. They do not wish to exert themselves unnecessarily, and they are aroused only when ease is more unbearable than action. But neither races nor individuals can stand still. They are either progressing or retrogressing. Adaptation is always going on.

An illustration of the psychological effect of working against resistance is seen in the occasional revelation of latent ability in men. Their achievements are usually below their maximum efficiency. They rarely do the best

of which they are capable. They grow to the smallest dimensions of their job and then stop. They do not make a little job into a big one. The reason for this, we have seen, is racial indolence. No more effort is expended in a piece of work than is required to produce a satisfactory result; and "satisfactory" is a variable quantity. There is usually no standard. Consequently, the result attained is far below the grade of which the individual is capable. It requires severe effort to maintain one's highest level of efficiency, and effort is a strain which one is loath to make. Consequently, lawyers, doctors, teachers, and business men are contented with efforts that bring fair results. So true is it that man is satisfied with the results which meet the lowest requirements of a situation that this human characteristic may be called the *tendency to minimum effort.*

To be sure, the quantity of energy expended in intelligent effort varies with individuals. There are those who conscientiously strive to secure the best of which they are capable. But these rare persons are seeking promotion or looking forward to achievements in other lines. They, also, are adapting themselves, but they are making their adaptation to distant demands which they hold in view. No one, probably, maintains his highest level of efficiency unless a continually exciting and varying stimulus is active in the environment. In this respect the lower animals are superior to man. They use all of their powers to the limit of their capacity; and man does not. At the outset he puts tremendous exertion into an undertaking. Then his efforts relax, perhaps at first gradually and imperceptibly, until finally he is acting on a level of efficiency much below his ability. It is, therefore, of supreme importance that young men and women, during their adaptive period, be associated with those whose standards of achievement are high—who stimulate to continuous effort toward better efficiency This is not merely that we may be shown how to do the work more effec-

tively but that the improvement-stimulus may be constantly operative. Only in this way can one keep alive at the growing-point.

At times, when a man is put into a position of exceptional responsibility, he throws himself into the work with the "sink-or-swim" determination, and then he displays power unknown to his friends or himself. Robert Louis Stevenson illustrates this when he makes one of his characters in *St. Ives* say: "There is no telling what a man can do until you frighten him." Sometimes the occupation for which one is fitted, as a great opportunity, reveals one's power. U. S. Grant is an example. But the most striking illustration is Patrick Henry. "His companions" [in youth] "recollect no instance of premature wit, no striking sentiment, no flash of fancy, no remarkable beauty or strength of expression; and no indication, however slight, either of that impassioned love for liberty, or of that adventurous daring and intrepidity which marked so strongly his future character. . . . No persuasion could bring him either to read or to work. On the contrary, he ran wild in the forest, like one of the aborigines of the country, and divided his life between the dissipation and uproar of the chase and the languor of inaction." [1]

Established in business by his father, his inattention and indolence caused speedy failure. Given a farm, he could not make a living. Another failure followed a second attempt in business. Then, not knowing what else to do, he tried law. Neither he nor his friends had any hope of his success. But the rest of his career is interwoven in our country's history. The circumstances that surround one are evidently tremendously important in determining whether latent abilities shall reveal themselves. An environment is either stimulating or inert. When stimulating it arouses ambition, effort, and will—the determination

[1] William Wirt, *Sketches of the Life and Character of Patrick Henry*, vol. I, p. 24.

to achieve—but if it is inert the adaptation is at the lowest level of efficiency. The individual then unconsciously, and quite likely unintentionally, expends his energy so grudgingly that he meets the minimum requirements of his work, or fails, as did Patrick Henry until he chanced upon a vocation that aroused all his latent powers. Here, then, is the psychological significance of adaptation. Let us consider it somewhat further.

As we ascend the animal series organisms become more complex. These higher forms represent the animals that have been able to adapt themselves to a wider range of conditions. The circle of requirements has enlarged. The change has not been sudden. Neither has it been conscious. It has been a blind struggle for survival. If the change is too rapid or the required alteration too great the animals cannot make the adaptation and the species perishes. Those that succeeded have built their new lives upon the graves of incapables. The trail through the prehistoric jungle to modern times is strewn with the remains of animals that failed to qualify for new requirements.

Education, in its broadest meaning, consists in coming into such *rapport* with the environment as to meet successfully the exigencies which arise. Adjustment is always an element in education, and in the lowest forms of life that is all there is to it. At this stage, then, education is wholly a matter of organic adaptation which results in physiological modification. The animal reacts differently to new conditions—behaves differently—because it is physiologically different. The education of man differs from that of the lower animals in the inclusion of factors which play no part in the development of lower forms of life. Adaptation, however, is no less forceful in its requirements and no less effective in producing alteration. Only now the changes are mental as well as physiological. Al Jennings, the reformed bandit and train-robber, and former leader of the once famous "Jennings Gang,"

has given an interesting illustration of adaptation from his own life. "I am always surprising my friends," he says, "by deductions which they take for a kind of clairvoyant instinct. For example, I will be sitting with a group of a dozen people having a talk. Some one will look up and say: 'Why, where's John gone?' No one but me will know. I can always tell when and how he left the room. Usually I have learned by his expression and gesture what made him leave, and all that without losing any of my absorption in the conversation. It wasn't so before I took the road; I got the habit in prison. That my old crimes raised me from a rough country practitioner to a real lawyer I haven't the slightest doubt." [1]

The writer doubts whether it was prison life which awakened his dormant mind. Daily, relentless need for the minutest observation and most rigorously exact interpretation of persons and events outside of prison did the work. Heavy rewards upon his head severely strained the loyalty of friends. Failure to read their faces, when forced by need of food to accept hospitality, meant capture or death. Illustrations are not wanting in his book. "If there were two men in the whole territory on whom I depended, they were Sam Baker and Red Hereford. I stopped at Baker's on my way out. His wife told me that he had gone to find us boys. Her manner made me a little suspicious. When presently Baker came in he seemed cordial enough, but he asked where we were going, approaching the subject indirectly. Curiosity about the other fellow's whereabouts wasn't etiquette in our set. The next day I made Red Hereford's with Bill, whom I'd met on the road. There, also, the atmosphere had changed. It wasn't what he said—it was his manner."

The game of adaptation is two-sided and the player must keep up with it. A changing, uncertain environment makes demands upon those in it, and an active mind

[1] *Beating Back*, by Al Jennings and Will Irwin, pp. 310 *ff.*

responds with its adaptations and reconstructions. Those who cannot meet the issues succumb either by suffering the supreme penalty of failure or by dropping to a lower level, where the less exacting demands can be met. In Al Jennings' world of that day the latter meant becoming cattle rustlers or ordinary thieves. To remain in the criminal aristocracy required intellect and bravery. Both of these Jennings had, and they came out when needed.

Prison-life adaptation is more likely to cause deterioration than to develop mental keenness. Robert Louis Stevenson observed this effect. "For it is strange," he says,[1] "how grown men and seasoned soldiers can go back in life; so that after but a little while in prison, which is after all the next thing to being in the nursery, they grow absorbed in the most pitiful, childish interests, and a sugar biscuit or a pinch of snuff becomes a thing to follow after and scheme for."

The sharpening of his intellect, which Jennings attributes to his life "on the road" and in prison, came from the need of the fullest development of all of his powers of perception, interpretation, and reasoning. Self-preservation is a stern and effective teacher. The conditions of his life called for certain responses—behavior—which were possible only as the result of functional changes. These changes were largely in the nervous system. He saw more, interpreted better what he saw, and reasoned more correctly on the basis of his interpretation.

That it is possible to see much more than is usually observed has been proven by Pfungst in his investigation of "Clever Hans," the so-called educated horse.[2] Without any further practice than was involved in making the experiments, Pfungst, playing the part of the horse, was able to see and interpret the unconscious movements of the persons, who *thought* three numbers together with their

[1] *St. Ives*, p. 2. See also *My Life in Prison*, by Donald Lowrie.
[2] *Clever Hans*, by Oscar Pfungst, 1911.

sum, so as to determine the order in which the numbers were mentally added. For example, a man thought of 12 as 5 + 5 + 2 and as 2 + 5 + 5, and Pfungst, as he tapped off the number with his hand, could determine by watching the man which order the number took in his mind. The significance for interpreting events of this sharpened observation and inference is obvious.

Adaptation to a changed environment is also seen in the altered conduct of States-prison convicts when placed under new conditions. These striking changes, which often amount to a revolution in the character of the prisoners, are so much a matter of general knowledge to-day that it is only necessary to refer to them. In Colorado, convicts have been employed making roads two hundred miles from the prison. The men were housed in tents and dugouts, away from the towns near at hand, and the camps were guarded only to keep away tramps and prowlers who might attack the commissary or carry away other property.[1] "For a long time the only man who carried firearms in one of these camps was a long-time prisoner who patrolled the place for the above reason. . . . We have now" [when the letter was written] "three hundred men employed away from the walls, and yet in the last eight months only one man has escaped."

Mr. Fremont Older, of the *San Francisco Bulletin*, has a former stage-robber as manager of his ranch. "He is absolutely honest and could be trusted with a million dollars. He has served four terms, aggregating thirty-eight years, for stage robbery and highway robbery, and he was considered the worst man in California."[2] Evidently adaptation has a wide reach in making and remaking men.

Perhaps the explanation of the change in these convicts when placed under a new environment is to be found in

[1] Information contained in a letter from Warden Tynan. Used with permission.

[2] From a personal letter. Used with permission.

a statement of an Oregon convict. Governor West was convinced that the shoe-shop of the penitentiary was inefficient. So he telephoned the warden and asked that a prisoner, whom he designated by number, be sent to him. The convict came unguarded. He was told that he should go to Oregon City, study the machinery of the shoe-shops, and report on what was needed to make those of the penitentiary efficient. He went, again unguarded, and on his return told the governor what was necessary to make the prison shoe-shops modern. The governor then said to him: "Now, you're in for life, a murderer. You have tried to get away before. Why didn't you try it this time?" "Well, I'll tell you, governor. I've tried it before. This would have been a pipe for sure. But it's the first time since I can remember that a man trusted me. I couldn't throw you down." [1]

These human pictures represent men's physiological and mental reorganization in a changed environment. They are wholly comparable to the adaptations of lower animals. Habits and actions—behavior viewed in the large—are not isolated states. They are responses to environmental situations, and they can be rightly appraised only when considered in relation to these environing conditions. Behavior involves two factors, the organism, and the objects or circumstances that it faces. The external conditions demand adaptive response. At one time this demand imposes the penalty of death for failure to meet it, and at another the ridicule of associates with all the anguish that accompanies ostracism.

The human will is not resistless. It is influenced by racial and individual traits, some of which originated in needs quite different from those of the present day. Consequently, the adjustment of action to environment is at times imperfect. Primitive man, like his animal ancestors,

[1] *New York Times*, May 2, 1912. Verified by a letter from the secretary of former Governor West.

expended tremendous strength and, having won his fight, relapsed into inaction, revelling in the fruits of his victory. Man is able to maintain a persistent battle-front only in extreme danger to his life. At other times he gradually relaxes his vigilance and finally, when resistance becomes too great a burden, he slowly yields. Witness the progress of reforms. A crying need is felt and volunteers are not lacking. But soon, confronted with continued opposition, enthusiasm wanes and vanishes, and things remain much as they were. The overwhelming but temporary outburst of indignation after the Iroquois Theatre and the Triangle Shirt-Waist Building burned, with their appalling loss of life, are illustrations. Enthusiasm comes in waves, but the effort needed to keep it going is too exacting.

All of these forms of behavior are phases of adaptation. In the case of the convicts of whom we have spoken, the social and industrial conditions confronting them required more mental, moral, and physical stamina than they had at their disposal. When, at a later time, the circumstances surrounding them favored an ethical, social attitude, when opposition to the unsocial did not require such strenuous, unremitting resistance, new adaptations followed. Only when it is recognized that will is an adaptive process, the outcome of pitting ideas, emotions, and thoughts, with their judgments, against surrounding conditions, will a social science be possible. As we shall see later, the will is not a "faculty"—a single, simple force. It is the whole mind active, impulses, emotions, ideas, and ideals, but it is active with reference to something external to it. Life is not action. It is reaction.

The illustrations of adaptation which we have given are those of individuals—made within the lifetime of one person. When we turn to racial adaptation an interesting observation has been made by Boas.[1] He claims to have

[1] *Senate Document*, No. 208, Sixty-first Congress, 2d Session, p. 7.

found that "the head form, which has always been considered as one of the most stable and permanent characteristics of human races, undergoes far-reaching changes due to the transfer of the races of Europe to American soil."

Another example is seen in Stefánsson's blond Eskimo of Victoria Island.[1] His measurements of 104 of these men "give an index of 97, which places the 'blond Eskimo,' when judged by head form, exactly where it places them when judged by complexion—in the class with persons who are known to be of mixed Eskimo and white descent." Naturally, adaptation was favored by cross-breeding, but if Stefánsson's theory is correct the Scandinavians who survived in their westward journey from Greenland must have practised very rigid adaptation. This is shown by the fate of early discoverers, as Sir John Franklin's party, who, though equipped with protecting devices and a reasonable quantity of food, could not meet the conditions sufficiently well to survive.

We have been discussing adaptations which were more or less successful and which made the individuals or group more efficient in respect to the exigencies that they fitted them to meet. But human adaptation is not fully illustrated by success. Let us therefore turn for a moment to some failures. If the death-rate increases it is evidence of lack of intelligent adjustment to conditions. And this is exactly what is happening in the United States to-day. Government reports show that the death-rate from organic diseases in this country has been steadily rising since 1880. It might be assumed that this is a necessary state of affairs due to uncontrollable causes involved in the progress of civilization were it not for the fact that during this period the death-rate from the same causes has not risen in European countries of a corresponding degree of civilization. "Coincident with the increase in the death-rate from or-

[1] Vilhjálmur Stefánsson, *My Life with the Eskimo*, 1913, pp. 192 *ff.*

ganic diseases in the United States, the advance has occurred in the *general* death-rate in all age periods, commencing with age forty to fifty." [1]

The last report[2] of the United States Census Bureau gives 1,001,921 deaths for the year 1916 in the "'registration area,' which contains approximately 70 per cent of the population of the entire United States. . . . Of these deaths nearly one-third were due to three causes—heart disease, tuberculosis, and pneumonia. . . . The deaths from heart disease (organic diseases of the heart and endocarditis) in the registration area in 1916 numbered . . . 159.4 per 100,000 population. The death-rate from this cause shows a marked increase as compared with 1900, when it was only 123.1 per 100,000." The mortality rate from Bright's disease and acute nephritis has increased, with some yearly fluctuations, from 89 per 100,000 in 1900 to 105.2 in 1916; and the rate from diabetes has risen almost continuously since 1900, when it was 9.7 per 100,000, to 1916, when it was 17 for the same number of inhabitants. Arterial diseases, again, have increased from 6.1 in 1900 to 25.6 in 1912; and the increase of the mortality rate from apoplexy has been continuous since 1913. These startling figures become even more impressive when it is remembered that an organic disease, especially of the heart or kidneys, makes the prognosis decidedly more unfavorable for an acute disease like pneumonia, and this was one of the three diseases that caused nearly one-third of the deaths in the registration area during the year. Tuberculosis, another of the three, still "causes more deaths annually than any other malady, except heart diseases, and about 37 per cent more than all external causes—accidents, homicides, and suicides—combined."

[1] E. E. Rittenhouse. Paper prepared from government reports and life-expectancy tables at the request of the Committee on Public Health Education of the Medical Society of the County of New York, and read at the Academy of Medicine.

[2] *Bureau's Summary of Mortality Statistics*, issued Nov. 27, 1917.

Yet tuberculosis is an eradicable disease if proper attention is given to fresh air and out-of-door exercise.

The general death-rate has declined in recent years, but this does not mean that the race is more vigorous. The decline in mortality is chiefly in infancy, childhood, and early adult life. And the reason is better defense against germ diseases. The evidence indicates that deaths from wear and tear are increasing. Vital statistics show that the expectancy of life from shortly before forty years of age has been gradually but steadily falling. The investigations of Rittenhouse indicate that during the last thirty years the death-rate from organic diseases has increased 86 per cent in Massachusetts and 94 per cent in fifteen American cities. And yet, while the death-rate from these causes has been increasing in the United States, it has been stationary or decreasing in England, Germany, Sweden, and France. Since these countries do not have better physicians than the United States, there can be but one explanation—lack of intelligent adaptation to the rapid changes which have been taking place during recent years.

The mortality rate from some of the organic diseases has doubled within forty years. A striking increase in deaths from diseases of the heart, arteries, and liver begins between thirty and forty years of age, the maximum being reached at sixty or shortly after; and when the decades preceding 1881 and 1911 are compared it is found that during the latter period the expectation of life has been lowered for all ages after forty. The condition which these statistics indicate has attracted the attention of the United States Public Health Service, which has sent a warning[1] through the country.

"At the age of forty the expectation of life," the statement runs, "is less now than it was thirty years ago. This is true for both men and women. Life expectancy

[1] *Exercise and Health*, by F. C. Smith, Government Printing Office.

during infancy and childhood has increased owing to more intelligent care of young children, to the introduction of diphtheria antitoxin, and other means of combating the infectious diseases, and to more sanitary living. But the diseases of degeneration are increasing, especially those involving the kidneys, heart, and blood-vessels, particularly among persons not employed at manual labor. One reason for this is the lessened physical and the increased mental work entailed by our complex social fabric. More people are engaged in sedentary occupations than formerly. More nervous energy is required of a man. Deprived of the natural assistance which physical exercise affords in eliminating through skin and lungs the waste products of the body, the kidneys become overloaded and fail. Lacking the normal assistance which working muscles give to circulation as they urge the blood and lymph onward in the natural channels, and overloaded with food poisons which brain-work cannot burn up as physical exercise will, the arteries become brittle and weak and the heart muscle flabby, like the biceps of its unfortunate possessor. The florid business man succumbs to apoplexy, perhaps; another big, pasty-complexioned brain-worker to nephritis; another to a fatty-heart or to chronically overtaxed digestion, all of which could have been postponed for many years by a moderate amount of daily exercise."

The lack of applied intelligence of *homo sapiens* is shown, again, by the report of the Committee of One Hundred on National Health. There are over 625,000 deaths annually in the United States which could be prevented, and at least half of the 3,000,000 sick-beds now constantly filled would be empty if the existing knowledge of hygiene were applied.

"The health examinations of the Life Extension Institute have revealed unsuspected ailments in persons who considered themselves well, and to an extent which has astonished even those who have long been familiar with

these subjects. Among large groups of clerks and employees of banks and commercial houses in New York City, with an average age of twenty-seven, and all supposedly picked men and women, only 1 per cent were found free of impairment or of habits of living which are obviously leading to impairment. Of those with important physical impairments, 88.88 per cent were, prior to the examination, unaware of impairment; 16 per cent of the total number examined were affected with organic heart trouble, 42 per cent with arterial changes, ranging from slight thickening to advanced arterio-sclerosis, 26 per cent with high or low blood-pressure, 40 per cent had sugar, casts, or albumen in the urine, 24 per cent had a combination of both heart and kidney disease, 47 per cent had decayed teeth or infected gums, 31 per cent had faulty vision uncorrected.

"Among industrial groups, not exposed to any special occupation hazard or poisoning, the figures were as follows: With an average age of thirty-three, none were found to be free of impairment or of living habits which are obviously leading to impairment. Of those with important physical impairments, 89 per cent were, prior to the examination, unaware of impairments; 3 per cent of the total number examined were affected with organic heart trouble; 53 per cent with arterial changes, ranging from slight thickening to advanced arterio-sclerosis; 23 per cent with high or low blood-pressure; 45 per cent had sugar, albumen, or casts in their urine; 26 per cent had a combination of both heart and kidney disease; 69 per cent had decayed teeth or infected gums; 41 per cent had faulty vision uncorrected."[1]

No single explanation for this physical deterioration can be given. Probably, however, the most fundamental cause is the sudden change, during the last two generations, from muscularly active lives, spent mostly out-of-doors, to

[1] *How to Live*, by Irving Fisher and Eugene L. Fisk, pp. 136 *f.*

physically inactive lives, lived chiefly indoors. The proportion of city inhabitants has increased more than 130 per cent in the last fifty years; and while our city population has increased 35 per cent during the last decade, the rural population has increased only about 11 per cent.

This change from an active out-of-doors life to the inside of the shop or office has started a physical impairment which city conditions have promoted. The body and organs cannot at once readapt themselves from a life of action in the open to sedentary conditions in confined, overheated, dried-out, devitalized air. After they have made their adaptation to these conditions the race will be a long way on the road to decline.

Speaking of these facts with reference to two of the prevalent diseases — arterio-sclerosis and diabetes — Crile says: "It is essentially a story of the modern world; of power and progress and success; of liberty and luxury, and of their antitheses. . . . The identification of the common causes of diabetes with the common causes of Graves' disease may explain why, in the words of a certain phrase-maker, 'When stocks go down in New York diabetes goes up'; why diabetes is more commonly found in large cities, among individuals and races who are constantly under a strain of business perplexities, and who are constantly within sight and hearing of thousands of irritating and harassing episodes, and why it is rare in localities where leisurely and quiet ways of life prevail." [1]

The physical waste produced by city life calls for stimulants and narcotics to speed up energy or dull the feeling of fatigue. Proof of this is not wanting. The annual consumption of alcoholic liquor, for example, has increased from 6.5 gallons per capita to nearly 20 gallons since 1860, and, as evidence of the significance of this, life-insurance companies have found that "the death-rate of very moderate drinkers among the insured is 18 per cent higher

[1] *Man: An Adaptive Mechanism*, by George W. Crile, pp. 225, 241.

and of steady drinkers 86 per cent higher than the average."[1]

Besides this, $1,200,000,000 worth of tobacco is annually burned, and, with probably still more disastrous effect, the consumption of coffee per capita has increased 54 per cent during the last two generations. Then, as another indication of the enervating effect of "civilized" life, 75,000,000 pounds of drugs are consumed annually, most of them, if druggists are to be believed, without the advice of a physician, and the yearly consumption of patent medicines and nostrums of one sort or another has increased 365 per cent per capita beyond that of thirty-five years ago.

If it be asked, What have these facts of physiology and hygiene to do with psychology? the answer is obvious. The mind is not an ethereal, spiritual force inhabiting the brain. Mental processes accompany certain cerebral processes, and the productivity of the mind is not unrelated to the vigor of the nervous system and of the body in general.

But other unintelligent adaptations are evident in modern social and especially urban life which hasten physical impairment. There is a dangerous tendency toward habits of physical ease. Athletics in schools and colleges are limited to a few. The others take their exercise vicariously on the bleachers. Increase in wealth has brought luxuries and ease. The apartment janitor or house man does the work formerly done by boys. Walking is rapidly becoming a lost art. People ride in street-cars or automobiles. Even the sauntering that boys do must conform to a certain "style" that predisposes to impairment. The "college slouch" is an illustration. An examination of 746 Harvard freshmen showed[2] that four out of every five stand and walk in a slumping posture, and that three out

[1] Address at the Tenth Annual Meeting of the Association of Life Insurance Presidents, 1916, by E. E. Rittenhouse.

[2] Lloyd T. Brown, M.D., *Harvard Illustrated*, vol. 18, p. 280.

of five do not know how to take a correct position even when they try. It was also found that the students who affect the slouch have a greater variety and a higher percentage of sickness than those who stand erect.

The physical deterioration of young Americans is strikingly shown by the rejections for physical causes among those who have applied for admission to the army or navy. Out of 562 candidates for West Point in 1914, 142 were physically unfit and were rejected. These figures are the more dismaying when it is recalled that all candidates undergo a preliminary medical examination before going to West Point. The conspicuously unfit, therefore, never reach the final examination to which these figures refer. Yet, out of those sent to West Point we find about one-fourth rejected for physical reasons.

The first draft under the Selective Service Act of 1917 furnishes the latest information regarding the physical condition of our young men. Of those called and examined 29.11 per cent were found physically unfit;[1] and yet, notwithstanding these disturbing figures, the commanding officers of several cantonments have complained that too many who were physically unfit have been sent to the camps.

Of those who applied for admission to the Naval Academy in 1914, 30 per cent were rejected; in 1915, 25 per cent, and in 1916, 16 per cent. In these cases, also, a preliminary physical examination eliminated the conspicuously unfit before they reached the academy. It is probable that the smaller number of rejections in 1916 was the result of lowering the physical requirement on account of the prospect of war, though at no time have the demands on "fitness" been unduly severe.

According to a statement issued in December, 1916, by recruiting officers of the United States Marine service, only 1 out of every 30 who applied for admission from

[1] *Report of the Provost Marshal General to the Secretary of War*, 1918.

Manhattan were in sufficiently good condition to be available. Referring to a large number of candidates, Captain L. P. Pinkston, of the New York City recruiting bureau, recently said that out of 11,012 applicants, only 316 could be accepted. Such is the physical preparedness of the men of New York City—1 in every 35 who applied is physically fit to be a marine! What are the chief defects? They are much the same the country over—heart trouble, flat chests, and flat feet. Too little walking makes flabby muscles and flat feet, and then flat feet forbid walking. It is one of those vicious little circles.

The mental effect of deterioration of the tissues of the bodily organs is evident. The will depends hardly less upon the stomach than upon the brain. It was no mere rhetorical flight of the imagination that led Henry Ward Beecher to cry: "It is as difficult for a dyspeptic to enter the kingdom of heaven as for a camel to pass through the eye of a needle." Aside from the physical effect, knowing that one is diseased plays a leading rôle in the drama of life. Thinking and judgment suffer, and the determined, efficient man becomes vacillating and unreliable.

We have seen that the changes which occur in the organism may be described in large part in terms of adaptation. The external environment is the stimulus to which the physical organism reacts. Only when the environment is static do physical alterations reduce to the minimum or cease altogether. Every significant change in the environment puts the organism out of harmony with it and some sort of reorganization and, finally, reconstruction is necessary if the environmental change is sufficiently great. Failure to make the adaptation perpetuates the lack of harmony which, with time, may become sufficient to cost the individual its life or even to annihilate the species. With a stationary environment there is growth but no development. Development implies a reconstruction—men-

tal and physical—leading to the restoration of a lost equilibrium between an organism and its environment. If this reconstruction produces greater organic complexity to meet more involved conditions of life there is progress.

Adaptation may take a form of response already perfected or in process of becoming fixed, or, again, there may be a tendency to alter the reaction to meet the varying needs of the environment. If the established response is continuous through the species—with the moderate variation observed in even so-called fixed reactions—it is instinct, and if it is peculiar to an individual it is habit. The ability of an organism to break away from established types of response—to adapt itself better to new conditions—measures its capacity to develop. When changed conditions in the environment are met by a responsive adjustment of behavior in the organism, the variation thus introduced leads to the establishment of a new reaction, which tends again to become fixed in habit. Along with the impulse to adapt and, when necessary, to readapt oneself to altered circumstances, there is always the tendency, as we have noticed, to do so with as little expenditure of energy as possible. Change, whether organic or mental, is always resisted. During any marked change in the essentials of an environment many perish because of inability to meet the new requirements. Those that survive make as little change in structure and behavior as will meet the exigencies of the situation.

The lower animals, we have said, must adapt themselves to the environment as it stands. They cannot make it over to any large extent. Their adaptation is therefore passive. Man, on the other hand, can entirely reconstruct his environment and in this way create new incentives to further improvement. An environment constantly changing under man's reconstructing and reorganizing ability presents a continuous succession of inducements to progress. The marvellous irrigation systems by which deserts

have been changed into fertile farms, and the transformation of water-power into electrical machines that supply distant cities with electricity are illustrations.

We have illustrated human adaptation somewhat at length because of its importance in human efficiency. Man is prone to think that his higher intelligence makes him superior to this organic tendency. Yet he is no less subservient to it than are the lower animals. Adaptation is relentlessly exacting. We cannot escape it. The only method of control is the indirect one of planning the conditions to which adaptation shall be made. And it is here that man's intelligence has a chance to assert itself. The convicts, to whom reference has been made, adapted themselves to two widely varying sets of conditions; and the results were so different as to exhibit in each convict two apparently antagonistic selves. Yet each manifestation of personality was true to itself and to the condition which drew it out. In helping others to develop, the effect of the conditions to which response is made is readily discernible because of the objective point of view. The problem is quite different, however, when it is a question of training oneself. This difference arises from the stealthy way in which adaptation works. Evidently the intellect should play a more discriminative part in planning the conditions to which human adaptation shall be made. We may therefore turn to the nature and method of thinking.

CHAPTER II

THINKING AND ACTING

We have seen that the man who would be efficient should strive to control the external conditions to which, sooner or later, he will inevitably adapt himself. We will assume then that the external conditions have been well planned with reference to efficiency—that the stage is set, so to speak. The next step is the organization of effective mental habits, and foremost among these, perhaps, is the subtle process called thinking. Suppose we pause a moment to correct a rather wide-spread error.

Thinking is not a spontaneous process, like breathing. To be sure, ideas come into the mind and are succeeded by others that have some sort of connection with the first. But this is not necessarily thinking in the proper sense. Mere succession of things thought of—even related things—need not be thinking. There are many ways in which things and their ideas may be related. Some of these ways have significant meaning under given conditions, and others have not. Thinking implies seeing real relations, not those that are fanciful or artificial; and these relations must lead somewhere. Some consequence should follow them. This consequence becomes a body of knowledge, perhaps a belief. Thinking also finds the reasons for a belief, if it is well grounded, and, if not, it exposes the insecure foundation.

Evidently, then, mere association of ideas does not constitute thinking. The test is in the kind of associated ideas that we have. Ideas may have no more significance than is disclosed in the prattle of infants. A few illustra-

tions will indicate the frequency of insignificant associations incorrectly dignified as "thoughts."

A "well-read" woman, for example, on hearing some one speak of the barren, degenerating lives of those in the slums, replied: "They should have good books to read, like those of Thackeray and George Eliot." And again, the manager of a large manufacturing plant on being told that the laborers in his mills were dragging out a joyless, hopeless existence, working ten hours a day six days in the week, said: "They don't know how to use their leisure time."

The arguments of political parties, to illustrate failure to think from a different angle, are often insulting to even moderate intelligence; yet they are not resented. A well-chosen slogan is frequently sufficient. But slogans presuppose absence of thinking. They are designed to awaken certain ready-made associations in the voters; and they take the place of arguments. Obviously, politicians assume that the public can be fooled long enough to win the election, and the voters accept their judgment. They therefore justify it.

If these illustrations are fairly chosen, and they are of a type sufficiently frequent to be rather commonplace, it is clear that ideas brought into the mind through association may revolve in a very small circle and, consequently, never advance thought. As a matter of fact, thinking is largely controlled by inheritance, tradition, and environment, including early education and social pressure; and it is partly for this reason that experience, as usually accepted, exerts such a dominating influence.

Merely living through a series of events, however, we have found does not give valid experience. Even activity —taking part in the events—does not make experience. Getting experience requires understanding causes and consequences—seeing connection between what precedes and that which follows. Change is meaningless transition un-

less it is connected with its results. When change is translated into cause and effect it is full of significance. We learn something.

The character of experience—indeed, the very realization of any experience at all—is determined by the proportions in which habits of response, on the one hand, and variability, on the other, enter as constituents into our thought and actions. When response becomes habitual experience is at its minimum. The quantity of experience, again, is measured by the amount of conscious, attentive reaction which is opposed to habits of thought and behavior. So far as situations fail to be adequately met with habits, adaptation tends to become conscious, new, and, to the extent of the failure of habits, inventive and original. With man, at least, any break with mental habits tends to be educative.

In the active affairs of life, however, experience usually settles what promises to be the efficient course to pursue. Here, as in other judgments, the test of the value of the decision is the success or failure of the plan in achieving the aims which are sought. Thinking is strictly an intellectual matter and in no sense a moral one. Its value depends wholly upon the accuracy of the process. The thinking of an Arsène Lupin in accomplishing his criminal purposes is as good as that of a Sherlock Holmes in thwarting them. The starting-point from which the thinking proceeds is itself a matter of experience and interpretation. The human being seems to be enclosed in a circle from which he cannot extricate himself. He begins with experience, or with the interpretation and estimate of the views of others which is determined by his experience. This interpretation, again, rests upon personal judgment, "fundamental principles," which will be shared by others in proportion as these people have had similar experiences and have reasoned with like accuracy from the same starting-point. The circle within which one reasons will be

large or small according as one's experience has been broad or limited, and in proportion to one's ability to discover meaning in the experiences of others and to reconstruct them in terms of personal experience. Probably some are born with a nervous organization that accepts certain types of "fundamental principles" more readily than do others. Mystics and believers in occult phenomena, for example, we always have with us. In the same way some are born with a brain that responds to music and poetry. But inherited tendencies no more than individual experience establish universally valid principles.

Since the ideas and beliefs with which we start will deflect even subsequently accurate thinking, it is of the utmost importance that they be subjected to the severest scrutiny at the beginning of an attempt to think out a question. From the moment of their acceptance, however, it is a matter of the accuracy of the intellectual operation by which new beliefs grow out of the facts and ideas accepted as a true starting-point.

Throughout this mental growth the interpretation of experience plays a directing rôle, and it is in just this interpretation that the difference between great and mediocre men lies. There are two classes of discerning men, each important and effective in his way; those who originate and those who, though unable to initiate in any large degree, are yet appreciative of the inventions of others. General George Meade seems to have been of the latter class. He was "not original in devising brilliant plans, but his clear understanding enabled him to discriminate between the plans of others."[1] Meade's success, considered in connection with his lack of inventiveness, reminds one of a remark once made by Oliver Cromwell: "To be a Seeker," he said, "is to be of the best sect next to a Finder." The willingness and ability to admit in action the value of ideas presented by others reveals an intellec-

[1] *The Story of the Civil War*, by William R. Livermore, p. 495.

tual freedom of no mean worth, even though it may not represent the highest cast of mind; for one evidence of mental inferiority is the fear lest accepting the opinions of others will stamp one as weak. For the same reason, men of small mental calibre in positions of responsibility do not wish to have bigger men than themselves under them. They dread the contrast. One of the proofs of Lincoln's greatness was his willingness to take into his Cabinet men of the largest ability whom he could find, regardless of political affiliations; and he endured criticisms and innuendoes from them which would have cut deeply into the self-esteem of a less able man.

The least effective use of experience is probably exhibited by the literal man who has no sense of proportion, no sense of humor. No two situations are exactly alike, and the efficient man, other things being equal, is the one who can make distinctions between them and discover differences. There are, of course, those who are foredoomed to follow rules, and whatever efficiency these people possess lies in strict adherence to prescribed modes of action. These men cannot interpret experience. They can only follow it. Deviation from rules, of course, always involves risk, but he who never dares achieves nothing. In its best expression life is a great adventure, or rather a continuous series of adventures, and the one who reads the meaning of events with clearest understanding makes discoveries or meets emergencies in ways wholly outside the ken of men of lesser attainments.

Illustrations could easily be drawn from science, but perhaps military achievements afford the most striking instances. In the early period of Napoleon's victorious career, for example, after he had stormed the bridge of Lodi and forced the passage of the river, one of the Austrian generals exclaimed indignantly: "This beardless youth ought to have been beaten over and over again; for who ever saw such tactics! The blockhead knows nothing

of the rules of war. To-day he is in our rear, to-morrow on our flank, and the next day, again, on our front. Such gross violations of the established principles of war are insufferable."[1]

Sherman's march to the sea, to cite another instance of disregarding rules, would have been a stupendous blunder except that it succeeded. He should have been surrounded and his forces cut to pieces, according to the rules of strategy. But nothing of the sort happened. The plan "was forged almost as a dream in that eager and fertile workshop from which dreams came so thickly. But the point is that, conceived as a dream, it worked out with exactly reasoned care, so that in the end success attended almost every step of it. It was no dream to lead a hundred thousand men two hundred miles through a hostile country and bring them out in perfect fighting trim, with a confidence in their commander which had grown with every step they took."[2]

Grant, also, in cutting loose from his base of supplies, as he did in his attack on Vicksburg, disregarded a military principle which no one but a fool, or a genius, would ever think of violating. Lee, to cite a different sort of an illustration, fought the battle of Antietam with a river at his back, an inexcusable violation of the "rules." But he had interpreted events. He knew the man in front of him, and he was certain that if he lost the battle he could extricate himself before McClellan would counterattack with sufficient vigor to bring disaster.

Many of Lee's moves, a recent reviewer says, "would be discredited because of the chances that he took. But he took them with his eyes open. He knew the art of war; knew what the odds against him were, and he was looking

[1] *History of Napoleon Bonaparte*, by John S. C. Abbott, vol. I, p. 96. A somewhat different wording of essentially the same thought is found in *Napoleon*, by Theodore A. Dodge, U. S. A., vol. I, p. 233.

[2] *Union Portraits*, by Gamaliel Bradford, p. 147.

for a decision. He could not gain it in any other way." When, for example, Lee divided his forces in the face of the enemy at Chancellorsville and sent Jackson on his famous night-march along the plank road to attack Hooker's flank, he knew that he was violating one of the most elementary rules of strategy. And Falkenhayn has recently repeated this "blunder," with amazing success. At the battle of Hermannstadt, although being attacked heavily in front, Falkenhayn nevertheless detached a considerable force from his right wing and sent it by a wide detour to fall upon the Roumanian rear. This flanking force had to traverse a wild, mountainous country without Jackson's plank road, and this made all the more glaring the violation of the rule that a force must not be divided in the face of the enemy. The only excuse for Falkenhayn's conduct was that it succeeded. The detached force sat down in Red Tower Pass directly astride the Roumanian line of retreat and supplies, and the newly acquired army of the Allies was thrown into hopeless disorder in its mad struggle to escape from the encircling fire of guns.

Violation of rules in the cases of which we have been speaking was not an exhibition of erratic thinking. These military geniuses saw and read the markings of strata of experience lying below the level of prescribed conduct; and what they read suggested actions and plans outside the field of intellectual vision of the less endowed. To know when to disregard rules is distinctive. Suggestions imply a capacity to be influenced, and some minds are impervious to suggestions that are not hammered in by concussion. The intellectually sensitive do not require shocks. The story of Newton and the falling apple is a historical myth but psychologically it is true. Some such story had to be invented because it represents the way in which a great mind acts. Things are continually happening that are loaded with suggestive meanings, but only the intellectually prepared can interpret them. Getting experience

is not merely living and acting. It is testing the effect of actions. We do something and then watch the result. But even close observation of the action and consequent reaction may not reveal the meaning of the experience. Many factors are involved which do not readily disclose themselves to the superficially observant person.

Every experience is a scientific experiment reduced to its lowest terms. If we do not plan the conditions of an experience as deliberately as of an experiment, the contributing factors must be isolated quite as carefully, that the part which each plays in the final outcome may be correctly determined. Experience is always prospective. It looks toward the future and furnishes principles of behavior. These principles are rules of action. They must be followed by people of mediocre attainments, and they represent efficiency up to a certain point—to the limit of mechanical efficiency. But to a certain few the trying out and testing of the behavior of men and things, with reference to their response to our actions upon them, yield a flood of suggestions regarding the meaning of the reactions; and these meanings involve the relation between the actions of the person who is seeking experience and the responses—behavior—of the other persons and things which he is trying in some way to influence or control. Interpretation of the way in which things and people behave when we try to do something to them—to alter them or their actions—and knowledge of the reasons of this behavior—discernment of the relations between our actions and their reactions—is experience. The military geniuses of whom we have spoken saw deeper meanings than rules express, and this was due to their penetrating vision and interpretation of what they saw.

The sagacity of some men is a constant source of amazement to those of moderate mental fertility. Wisdom, however, is not a miraculous product. It comes, just as do the less striking thoughts, through association of ideas. The mind of the genius works in exactly the same way as

that of a plodder. The difference is that the genius sees more meanings than others, and he sees them more quickly. Suggestions are fertile with him; but one prerequisite of mental fertility is well-ordered, adequate knowledge. The need of abundant knowledge is evident because it is the source of meanings by which the world's confusion may be interpreted. But this knowledge must be organized so that its variety may not prevent concentration of available portions upon a definite problem. Unorganized knowledge is only wayward information, unfitted for application because incapable of being combined into a single impulse leading toward a definite conclusion. A man cannot be wise on nothing, and no amount of information need make him wise. Malthus' *Essay on Population* would have left Darwin and Wallace floating on the surface of conventional biological beliefs had they not been loaded with intellectual high explosives.

Yet men of genius are more conservative than is sometimes thought. All of their ideas do not flower. They pull up many and throw them away. Kepler is a striking illustration of the mistake in assuming that genius has an unerring method of divining truth. His contributions to our knowledge of the orbits and motions of planetary masses are so fundamental that one might easily think him the possessor of a special method or "faculty" of discovering truth. But he had many "strange views" and fell into numerous errors. All of his ability would have availed him nothing had he not constantly maintained the attitude of the trier, the tester, the experimenter. He failed repeatedly and his hypotheses were often dreams of a wayward moment, but he was relentless in his experimental criticism of them. Experience with him meant experimenting, as it always must if it is to contribute conclusions of value. Who would be willing to assert that Kepler's "chimerical notions" were not, after all, stages in his progress toward truth?

"In all probability the errors of the great mind," says

Jevons, "exceed in number those of the less vigorous one. Fertility of imagination and abundance of guesses at truth are among the first requisites of discovery; but the erroneous guesses must be many times as numerous as those which prove well founded. . . . The truest theories involve suppositions which are inconceivable, and no limit can really be placed to the freedom of hypothesis." [1] Faraday, again, in a paper on ray-vibrations says: "I think it likely that I have made many mistakes in the preceding pages, for even to myself my ideas appear only as the shadow of a speculation, or as one of those impressions on the mind which are allowable for a time as guides to thought and research." [2] "The world little knows," continues Faraday, elsewhere, in the same vein, "how many of the thoughts and theories which have passed through the mind of a scientific investigator have been crushed in silence and secrecy by his own severe criticism and adverse examination; that in the most successful instances not a tenth of the suggestions, the hopes, the wishes, the preliminary conclusions, have been realized." And it is the same with those working in the more practical field of invention. Edison, for example, once remarked that he could say without exaggeration that he had constructed three thousand different theories with regard to the electric light, "each of them reasonable and apparently likely to be true." Yet only in two cases did his experiments prove the truth of his theory.[3]

Theories do not reveal their own truth or falsity. The meaning of the facts from which they follow must be understood, and here the critical discrimination and sagacity of the experimenter is tested. Horace G. Hutchinson gives an amusing illustration of the view commonly held that "facts" carry their own light, which illumines them so brightly that their significance is apparent to all.

[1] *The Principles of Science*, by W. Stanley Jevons, p. 577.
[2] *Experimental Researches in Chemistry and Physics*, p. 372.
[3] George Parsons Lathrop, *Harper's Monthly*, vol. 80, p. 425.

"Shortly after the publication of the *Origin of Species*, Mr. Lowe" [the Chancellor of the Exchequer] "and Mr. Busk" [President of the College of Surgeons] "were at High Elms" [visiting Sir John Lubbock]. "On Saturday evening Mrs. Lowe was between young Lubbock and Mr. Busk, and the conversation turned on the great book. Mrs. Lowe asked Mr. Busk 'just to explain' why one germ should develop into a man and another into a kangaroo. He suggested that she should read the book, and so she took it up-stairs. Next day she sat in the drawing-room with it, and finished it about 4.30, shutting it up with a clap and saying: 'Well, I don't see much in your Mr. Darwin after all; if I had had his facts I should have come to the same conclusion myself.'"[1]

Since the method by which geniuses solve their problems is the same as that used by the ordinary man in meeting the difficulties of his business or profession, it is worth while to examine the process briefly.

First of all, it should be observed that if everything ran smoothly there would be no thinking. Like everything else, thinking requires a cause, which in this instance is trouble. Doubt, perplexity, uncertainty, an obstacle in the way of what we want to do—all are different names for troubles of one sort or another that interfere with our activities, physical or mental. So long as an automobile is in perfect running order the driver is not concerned with its mechanism. But let it go dead, with seventy-five miles to dinner and the nearest garage, and he is keenly interested in the cause of the trouble.

The recognition of trouble, however, either in something that we are trying to do or in finding the explanation of a problem is only the incentive to thinking. The cause of the difficulty must be understood before a remedy or a solution can be found, and here we have the second factor in thinking. In certain respects this is the most difficult part of the reasoning process, because most events are

[1] *Life of Sir John Lubbock*, by Horace G. Hutchinson, vol. I., pp. 50–51.

exceedingly complex, and the associated incidental factors are so intertwined with the essential elements that it is not easy to separate the essential from the accidental. Science has a way of meeting this perplexity. Experiments are arranged in which one possible cause after another is eliminated, and others, perhaps, exaggerated. In this way, by the process of elimination, the cause of a phenomenon is ascertained.

Certain peculiarities of electricity, for example, must have been observed in ancient times, in lightning, in the aurora borealis, in loadstone, and in certain other substances. In some of these cases the activity was too intense and rapid. In others it was too feeble and obscure. Machines and experiments were needed to produce a continuous supply of electricity of such an intensity as would make it possible to see and test what actually happened. From early times, also, it has been noticed that the tides vary with the phases of the moon. Some connection between these phenomena was assumed, but there was no accurate knowledge of the relation until Newton announced the law of gravitation. Mere observation is likely to be misleading. It would never have shown, for example, that air may exist as a liquid and as a solid.

In many matters, however, as in business and social problems, experimentation is not easy, and frequently it is impossible. Yet these questions are no less complex and involved than the scientific problems to which we have referred. In the former as well as in the latter the difficulty or obstruction in the way of successful progress in thought and action must be located and defined. The ledger does not show the profits which the business conditions lead one to expect. What is the explanation? Is the cause to be found in the internal organization, or lack of organization, or should it be sought among the salesmen? The cause and remedy of political corruption, to cite another instance, has long been a matter of contro-

versy. The ramifications of this disease of the body politic are so extensive that many other social disturbances spring from it. As this is being written there are indications that we are soon to try a tremendously big experiment—the elimination of the saloons. Whatever one's ideas may be regarding "personal liberty" and "legislating men good," it must be admitted that this is the scientific method of locating the cause of the trouble.

This experiment of dispensing with saloons illustrates what is usually called the third step in reasoning—suggestions for remedying the difficulty. As a matter of fact, this is not the usual order of the factors in the process of thinking. Suggestions commonly arise before the difficulty is defined. The wise man, however, suspends judgment, delays acting on suggestions, until the cause of the trouble has been located. Unfortunately, however, wise men are rare, and consequently suggestions are acted upon hastily and impulsively before the difficulty has been carefully diagnosed and the cause located. It is the trial-and-error method on the animal level—the hit-or-miss method. Yet it is not the way of men who have realized on their ability. Napoleon, for example, once said: "If I appear to be always ready to reply to everything, it is because, before undertaking anything, I have meditated for a long time—I have foreseen what might happen. It is not a spirit which suddenly reveals to me what I have to say or do in a circumstance unexpected by others—it is reflection, meditation." [1] Evidently Napoleon measures up well to the type of which H. G. Wells was thinking when he made Mr. Britling say: "Will there ever be a man whose thoughts are quick and his acts slow?"

One of the most charming illustrations of suspended judgment and sensitiveness to suggestion—ability to discover meaning in commonplace events—is the means by which James Bradley explained the apparent movements

[1] *Napoleon at Work*, by Colonel Vachée, translated by G. F. Lees, p. 7.

of the stars about which he had long been puzzled. "One day when Bradley was out sailing he happened to remark that every time the boat was laid on a different tack the vane at the top of the boat's mast shifted a little, as if there had been a slight change in the direction of the wind. After he had noticed this three or four times he made a remark to the sailors to the effect that it was very strange the wind should always happen to change just at the moment when the boat was going about. The sailors, however, said there had been no change in the wind, but that the alteration in the vane was due to the fact that the boat's course had been altered. In fact, the position of the vane was determined both by the course of the boat and the direction of the wind, and if either of these were altered there would be a corresponding change in the direction of the vane. This meant, of course, that the observer in the boat which was moving along would feel the wind coming from a point different from that in which the wind appeared to be blowing when the boat was at rest, or when it was sailing in some different direction. Bradley's sagacity saw in this observation the clew to the difficulty which had so long troubled him. . . . He argued that as light can only travel with a certain speed, it may in a measure be regarded like the wind, which he noticed in the boat. If the observer were at rest, that is to say, if the earth were a stationary object, the direction in which the light actually does come would be different from that in which it appears to come when the earth is in motion. . . . Provided with this suggestion, he explained the apparent movements of the stars by the principle known as the 'aberration of light.'" [1] This incident in the life of Bradley is comparable in every way to the mythical story of Newton and the apple, which scientists have been so eager to deny lest it remove some of the gloss from scientific thinking. As a matter of fact, reasoning

[1] *Great Astronomers*, by Sir Robert S. Ball, London, 1907, pp. 194–196.

about scientific problems is the same as that which is concerned with the day's work. Discovering the essential element in a bit of experience, and seeing its meaning in relation to the more important questions that trouble one, is thinking.

Failure to suspend judgment until the essential factors are discovered, and to persevere in the investigation until they are found, is the explanation of many blunders in business and in social reform. Ninety per cent of the business ventures are said to be failures, and this is the chief cause. Suspended judgment is not a popular state of mind. Men like to decide and act. An unsettled state of mind is not pleasant.

The habit of suspending judgment, therefore, is not easily acquired, and there is always a strong tendency to interpret facts so as to make them fit and justify our beliefs. Before Kepler's day, for example, planets were assumed to move in circles. If one were found that did not conform to this "law," it was made to agree by saying that the circle in which the planet moved described another circle. Tycho, again, vigorously opposed the Copernican theory, and, by the irony of human psychology, Kepler used Tycho's own observations to add to the proof of the new idea which the master observer had so stoutly denied. And the facts which Owen had patiently collected, to cite another instance, and so serenely interpreted in support of his erroneous belief, were utilized by Darwin in his epoch-making generalization regarding the origin of species. "We all believe many things which we have no good ground for believing," Bertrand Russell has said,[1] "because, subconsciously, our nature craves certain kinds of action which these beliefs would render reasonable if they were true."

When Fulton presented his plans of a submarine boat to the British Government—to continue our illustrations of

[1] *Why Men Fight*, pp. 5 *f*.

the tendency to hold to fixed opinions—the ministry appointed a commission of five men to examine the matter. So unwilling, however, were the members of the commission to suspend judgment and investigate—so sure were they of the worthlessness of Fulton's invention—that, after many weeks of delay, they gave an adverse report without even asking Fulton to explain his plans and without having any account before them of the tests and experiments which he made. The submarine boat referred to in the report was large enough to carry eight men with provisions for twenty days. While under water a reservoir supplied the eight men with air for eight hours; and Fulton himself with three companions had remained under water for one hour.

We are accustomed to say that such things happened a long time ago, and to think that they could not occur now, but a very recent event comparable in all essential respects to the Fulton incident is the treatment which Langley received while working on the aeroplane. The first achievements of the "flying-machine" brought fulsome praise—as success usually does—and a government grant of fifty thousand dollars was easily obtained for the continuance of the experiments. Then difficulties appeared, chiefly with the engine, since the automobile industry had not yet forced its perfection. The preliminary grant was soon exhausted and more money could not easily be obtained to carry on the ludicrous experiments of a science crank. The unscientific editors of science notes in newspapers began to jeer, and "Langley's Folly" was the joke of small-calibered congressmen. Langley's vindication came, however, in the spring of 1914, when Glenn Curtis wiped the dust from the exhibit of insanity and made the "Folly" fly. We now know that Langley discovered the essential principle of aeroplanes, and with a little more financial aid he would have made the United States Government, instead of private individuals, the ruler of the air. And his death was hastened by a broken heart because of the

ridicule heaped upon him. Now that he is gone, his name is enrolled among the memories of the throng who gave their lives to science and died unappreciated.

It would seem from the treatment of the men whom we have named, and who are typical of a long list of those who offered something new, as though the incident reported of an Italian town during the Middle Ages were representative of human experience: "The citizens of a certain town—Siena seems to be meant—had once an officer in their service who had freed them from foreign aggression; daily they took counsel how to recompense him, and concluded that no reward in their power was great enough not even if they made him lord of their city. At last one of them arose and said: 'Let us kill him, and then worship him as our patron saint.' And so they did." [1] Evidently, a recent writer in the *Atlantic Monthly* was right when he said that "Dead radicals are honored, not because they were radicals, but because they are dead." [2]

"The undisciplined mind," says Dewey, speaking of suspended judgment, "is averse to suspense and intellectual hesitation; it is prone to assertion. It likes things undisturbed, settled, and treats them as such without due warrant. Familiarity, common repute, and congeniality to desire are readily made measuring rods of truth. Ignorance gives way to opinionated and current error—a greater foe to learning than ignorance itself. . . . Our predilection for premature acceptance and assertion, our aversion to suspended judgment, are signs that we tend naturally to short-cut the process of testing. We are satisfied with superficial and immediate short-visioned applications. If these work with moderate satisfactoriness, we are content to suppose that our assumptions have been confirmed." [3] Yet delay, pending inquiry and investigation, is the scientific method, and it is the only dependable

[1] *Civilization of the Renaissance in Italy*, by Jacob Burckhardt, p. 23.
[2] Seymour Deming, *Atlantic Monthly*, vol. 113, p. 587.
[3] *Democracy and Education*, by John Dewey, p. 222.

plan of action. It is the essence of critical thinking. Following this plan, the managers of one of the most successful chains of restaurants in large cities are said never to decide upon a new location without having the people who pass proposed locations counted at noon and evening for a number of days. In this way one source of error is eliminated, and the business problem then resolves itself into furnishing as good a meal for the money as is offered by other restaurants in the vicinity.

Usually problems are not so simple as this business question, and the suggestions looking toward their solution must come through the use of a trained and controlled imagination; and in this connection some reflections of Faraday are interesting. He could not rid himself of the conviction that gravity is connected with other forces of nature. "Gravity—" he said, "surely this force must be capable of an experimental relation to electricity, magnetism, and the other forces, so as to bind it up with them in reciprocal action and equivalent effect." He was convinced that as two bodies approach one another, electricity is developed in each. Then, in a moment of hesitation and doubt, if not discouragement, he wrote in his laboratory notes: "All this is a dream. Still, examine it by a few experiments. Nothing is too wonderful to be true, if it be consistent with the laws of nature; and in such things as these, experiment is the best test of such consistency." So he continued his efforts to ascertain the facts, but many difficult and tedious experiments yielded nothing conclusive. At this point, feeling that he had done all that he could without time for reflection, he wrote: "Here end my experiments for the present. The results are negative; they do not shake my strong feeling of the existence of a relation between gravity and electricity, though they give no proof that such a relation exists."

Ten years later he returned to these experiments, having been working upon other problems during the mean-

time. "Let us encourage ourselves by a little more imagination prior to experiment," he wrote in his notes as a sort of personal censor. "And then he reflects upon the infinity of actions in nature, in which the mutual relations of electricity and gravity would come into play; he pictures to himself the planets and the comets charging themselves as they approach the sun; cascades, rain, rising vapor, circulating currents of the atmosphere, the fumes of a volcano, the smoke in a chimney, become so many electrical machines; for a moment his reveries have the vividness of fact, and he sums up rapidly the consequences of his great but imaginary theory; an entirely new mode of exciting heat or electricity, an entirely new relation of the natural forces, an analysis of gravitation, and a justification of the conservation of force." [1] Then, perhaps in a moment of exultation, he wrote: "I think we must have been dull and blind not to have suspected some such results." But he did not allow his imagination to run rampant. "Let the imagination go, guarding it by judgment and principle, holding it in and directing it by experiment." When all was done and experiments had been cleverly contrived to eliminate the influence of the earth's magnetism by devices that only his consummate skill could suggest, the results were inconclusive. "The experiments," he wrote at the end, "were well made, but the results are negative. I cannot, however, accept them as final."

Faraday's reflections during this period of experimentation have been quoted at some length, because it is doubtful whether a better illustration of the correct method of thinking can be found—clear recognition of the difficulty, accurate definition of the problem, getting the facts, suggestions—the free but guided play of the imagination,

[1] *The Principles of Science*, by W. Stanley Jevons, London, 1900, pp. 590 *f.* See also Faraday's *Experimental Researches in Electricity*, vol. 3, 14th series, p. 161.

with its resulting hypothesis—suspended judgment, and constant attempt at verification or refutation. And there is no other method of thinking, whether it be in science or in the affairs of every-day life.

Faraday's scientific imagination, keenly sensitive to the meaning of his observations, guessed more accurately than the methods of experimentation in his day could demonstrate; for, to take a wide leap in time, Professor Nipher, of Washington University, has just proved that a relation does exist between gravitation and electrical action. The results of his experiments "seem to indicate clearly that gravitational attraction between masses of matter depends upon their electrical potential due to electrical charges upon them."[1] It has long been known that it is impossible to account for the motion of Venus and Mercury by Newton's law. Arbitrary terms, the meaning of which no one understood, had to be introduced into the equation, and Professor Nipher's work shows that what has been called the Newton gravitation constant is not a constant. Its value depends upon the electrical condition of the bodies.

Returning to the method of thinking, the productive, creative imagination is the mind playing around facts; and the "little more imagination" with which Faraday thought "to encourage" himself, "prior to experiment" was his way of expressing his search for a hypothesis which would stand the test of facts and account for the scientific difficulties which he had discovered. Kepler's discovery, again, that the orbits of the planets are ellipses was a brilliant guess, but his guess was based on facts—observations—accumulated by Tycho. Upon these facts his imagination played, and to the end of his life he was ignorant of any reason why planets should move in such curves.

The way in which a trained imagination uses facts to

[1] *Science*, vol. 46, pp. 293 *f.* *Transactions of the Academy of Science of St. Louis*, vol. 23, no. 5.

discover truths is shown in Halley's study of comets. He learned that a comet had been observed at intervals of seventy-five or seventy-six years, and his disciplined imagination leaped to the conclusion that comets are not chance visitors to the solar system, portending disaster, as had previously been thought. These several visitors, he said, are one and the same comet. So he proceeded to prophesy, but always on the basis of facts. The disturbance caused by the attraction of planets had to be computed. The result of these disturbing influences is that the comet does not describe the simple ellipse that it would if the sun were the only controlling force. Taking all known influences into consideration, Halley found that his comet should reappear at the close of the year 1758 or the beginning of 1759. On Christmas day, 1758, his hypothesis was verified by the reappearance of the expected comet, which passed through its nearest point to the sun in March, 1759. It will be recalled by many that this comet visited us again in 1910, amazingly near schedule time, considering its long journey and the number of alluring attractions that it encountered in its course. It missed the predicted time by two and seven-tenth days.

To be sure, matters of every-day life cannot be subjected to the same rigorous examination as can scientific questions, but the methods and precautions are the same. The difference lies rather in the exactness of the method as it may be applied in the laboratory. Perhaps, after all, it is the mental attitude that counts most. Conviction that mere observation is not likely to discover the meaning of a complex situation, ability to hold the judgment in suspense until the matter has been fully investigated, will go far toward reducing errors of opinion and decision.

Let us now consider some of the obstacles to correct thinking which arise out of the fact that thinkers are human beings with the characteristics that have come to them through the process of evolution. We have seen that

the first thing to do in defining a problem after recognizing the difficulty is to find out the facts. It has already been shown by illustrative examples that hypotheses—the assumed cause of something that has happened—to be worth anything must rest upon facts; but the sin of hasty conclusions is so common in the thinking of every-day life that the matter deserves further consideration.

When King Charles asked the Royal Society to explain the curious "observation" that a live fish placed in a bucket of water does not increase the weight of the bucket and its contents, the members of the Royal Society wisely began by investigating the question of fact. Again, when the objectors to the Copernican theory said that if the earth were moving, a stone dropped from the top of a high tower would be left behind, *just as is the case with a stone dropped from the masthead of a moving ship*, the Copernicans should first have tested the latter part of the statement of fact; and had they used proper precautions in the experiment they would have shown that, barring the effect of air-currents, the statement is untrue. As regards the first part of the objection, it may be asking too much to have expected at that time the rigorous care and accurate measurements which would have been needed to demonstrate experimentally, as Benzenberg did later, that a stone dropped into a deep well is actually deflected slightly toward the east.

To cite an instance from daily life of the importance of getting facts, the war has forced business men to face certain problems that existed for them before the war but which they did not see until compelled to do so by having their supply of raw material cut off. In despair, they turned to the men who know—to the scientists in those fields; and then, to their amazement, they learned not only that this raw material is available, either in the United States or in some near-by neutral country, but, in addition, that the commodity from the new source is not only as

good or better but also cheaper than that which they had previously imported from a greater distance. They did not have the facts. Before the necessity was forced upon them the manufacturers did not believe that uncommercial scientists could give business men advice. It is another illustration of the psychological principle of conservatism and habit—the *tendency to minimum effort.*

Interpreting facts, however, is much harder than collecting them. Indeed, the question of whether there are any facts worth getting, whether everything bearing on the matter is not already known, is one test of mental acumen. Only to the intelligent do problems present themselves. To the simple everything is simple. An environment may be rich in its possibilities for experience, yet yield nothing. It requires more than paying ore to produce gold. Many a prospector has failed to read the signs. In thinking, this mental blindness is caused by inability to see a problem. Facts do not exist for those to whom they have no significance; and when facts have no meaning there is no problem. It is said that we interpret new ideas by means of what we already know; and this is so true that the new is often accepted only to an extent that does not disturb the old ideas. Finding it necessary to retreat man makes a "strategic withdrawal," and then deceives himself by producing mental smoke that obscures the issue. This is one way—not uncommon—of interpreting the new in the light of the old.

When Torricelli, for example, discredited the Aristotelian dictum that nature abhors a vacuum, by showing that water would rise more than thirty-three feet in a pump, and mercury only about thirty inches in a glass tube, his opponents did not abandon their discredited belief. They *modified* it sufficiently to take in the facts observed by Torricelli. Nature, they said, abhors a vacuum up to a certain point but no further. Analogous cases are observed to-day in such expressions as "Socialism is good

up to a certain point"; and, again, "A man's will is governed and determined by law to a certain point, and then freedom of choice occurs." Those who use this last bromide are forced to admit the application of the law of causality "up to a certain point" in order to find a fulcrum for their moral lever. If the will were wholly unresponsive to causes, Sunday-schools, social settlements, and all attempts to improve children and adults by bettering their environment would be useless, because the moral ideas and habits could not be depended upon to influence action. Such a will would be anarchistic. Consequently, *some* effect must be admitted. But, as with the Aristotelians in the controversy with Torricelli and the pump, the admission must not go so far as to jeopardize the original belief.

This unwillingness to discard a cherished belief springs in part from a strong human impulse to estimate the truth of new ideas by the system of thoughts which one has accepted in large measure unconsciously. A ready-made classification of ideas preserves consistency by forbidding change. With such a classification all that is necessary is to fit it on to the new discovery, and then no violence is done to the harmony of one's system of thoughts. So, when fossils were first found they were explained, among other ways, as models made by the Creator before he had fully decided upon the best form in which to create the various animals.

When anæsthetics were discovered, to illustrate further, a storm of protest arose against their use. Again the stock ideas prevailed. Pain was God-given, it was said, and any attempt to alleviate it was an effort to thwart his will. But a Scotch physician, Doctor James Simpson, who knew something about psychology as well as medicine, after long and bitter opposition, brought the startling innovation into harmony with the prevailing system of ideas by writing a pamphlet in which he said: "My oppo-

nents forget the twenty-first verse of the second chapter of Genesis. It is the record of the first surgical operation ever performed, and that text proves that the Maker of the universe, before he took the rib from Adam's side for the creation of Eve, caused a deep sleep to fall upon Adam." This recognition of the way in which the human mind acts won the day for anæsthetics.

From one point of view facts may be roughly divided into two classes: First, those which have a purely objective aspect, *i. e.*, those unattended by personal bias, as facts of electricity and gravitation to-day; and, second, those that oppose opinions and beliefs held dear. Interpretation of the first is difficult because of the many intricate relations and connections.

Difficult, however, as it is to interpret facts which are unattended by personal bias, it is much harder, indeed, all but impossible, to understand those which oppose our cherished convictions. The mind of man is like a poorly made mirror. It distorts the facts that it reflects. Opinions and beliefs are true because we have long been surrounded by them. They are the views of "our set." "The vast majority of persons of our race," Francis Galton once said,[1] "have a natural tendency to shrink from the responsibility of standing and acting alone; they exalt the *vox populi*, even when they know it to be the utterance of a mob of nobodies, into the *vox Dei*, and they are willing slaves to tradition, authority, and custom. The intellectual deficiencies corresponding to these moral flaws are shown by the rareness of force and original thought as compared with the frequency and readiness with which men accept the opinions of those in authority as binding on their judgment. . . . Fickleness of national character is principally due to the several members of the nation exercising no independent judgment, but allowing themselves to be led hither and thither by the successive journalists, orators,

[1] *Inquiries into Human Faculty*, pp. 69, 81.

and sentimentalists who happen for the time to have the chance of directing them." One does not need to go beyond one's own circle of acquaintances for illustrative examples; and this gregarious thinking, which seeks to maintain views rather than to ascertain the truth, produces adventitious tendencies that throw an illuminating sidelight upon several phases of human behavior.

It has long been known, for example, that any statement, however meaningless, acquires significance if repeated often enough. So it is with ideas. They appear true by long association with them. Then, of course, they are vigorously maintained. It is indeed a curious fact of human psychology that the more unanswerable the arguments the more prone the vanquished is to deny them. "So long as an element of doubt is admissible," says Gotch in his review of the scientific method, "an opponent will suffer the inference to be drawn without a violent outburst; but when the inference is logically certain and the opponent is forced to admit his error or stultify himself, he may, it is true, maintain a magnanimous silence, but generally he fails to do so; he becomes greatly perturbed, and denies everything, even the most demonstrable facts. There is no greater incentive to unreasonable anger than the conviction that our position has been shown to be erroneous, and that in our inmost souls we are fully conscious of its hopeless character." [1]

One of the striking effects of fixed opinions is that they prevent us not merely from accepting arguments in opposition, but also from understanding these opposing arguments—and this is far more serious. We cannot follow a line of reasoning which is antagonistic to a strong emotional prejudice. Cuvier, unable to see the meaning of fossils, and Owen laboriously gathering arguments for Darwin without understanding them, are illustrations. When Sumner, to illustrate further, was asked whether he

[1] *Lectures on the Method of Science*, Oxford, 1906, edited by T. B. Strong.

had ever looked at the other side of slavery, he replied, "There is no other side." Yet we all know to-day that the South believed there was an economic side, recognition of which might have saved the losses and horrors of the Civil War.

If we ask for the cause of fixed opinions we come upon an interesting characteristic of human psychology which largely determines the course of thoughts and actions. The related experiences of an individual become organized into a system of ideas that decide his outlook and opinions in matters upon which the experiences have any bearing. These systems of thought have been called mental complexes. Enthusiasts display them in their hobbies, and here they are often valuable because they afford relief from the strain of work. Enthusiasm for golf is an illustration. The golf complex makes everything relating to the game interesting and the player's thoughts are easily turned in that direction. But, besides rendering the service of relief from work, mental complexes are the cause of blind adhesion to parties and "bias" toward all questions to which the systems of thought apply. Usually more or less emotion is intermingled in these complexes, and when they are emotionally saturated they become sentiments. Then the all but irresistible control of the complex is as unassailable as adamant.

These mental complexes determine the course of thoughts and forbid logical thinking. Evidence is not weighed impartially. They are the more disastrous to accurate reasoning because the individual is not aware that he has them. The belief that men generally know why they hold certain opinions is erroneous. The mental bias settles the line that thoughts shall take. Thinking is often a rearrangement of our prejudices. Man, however, craves consistency, so the usual procedure is first to come to an opinion, and then to find "reasons" for holding it. We make believe that we may believe. Gladstone, according

to Frederick York Powell, is a good illustration. Speaking of his "pig controversy" with Huxley, Mr. Powell said: "Gladstone was never really honest with his own mind. He meant to be honest, but . . . he was a terrific self-deceiver." [1]

Mental complexes—organized systems of thoughts—we must have. We cannot escape them and perhaps it is best that we should not. But efficient thinking requires that they be kept clear of emotional obscurity. If one were to ask oneself for the reasons for one's opinions, in a large majority of cases it would be impossible to find a convincing answer. Mental complexes unconsciously acquired and colored by personal emotions have established the belief. Yet to estimate the worth of arguments it is necessary that they be viewed objectively. Thoughts should be kept free from confusing alliances with self-interests and desires—free to move upon one another and make new combinations. And, above all, a man must know that he has these organized systems of thoughts, many of which are suffused with emotions. He who believes himself free from them is hopeless as a thinker.

Since, as we have said, the mind demands at least superficial consistency, and since no one is wholly good or wholly bad, two opposing systems of ideas are commonly held apart and not allowed to conflict. Illustrations are more common than one could wish. It is a familiar fact, for instance, that people who would indignantly deny that they are dishonest will rob the government, railroads, or stockholders; but they would not swindle individuals. Office-holders and politicians who accept graft in the form of "favors" belong to this group; and the recent case of an American woman "of high moral ideals," who had done heroic, self-sacrificing work among the wounded soldiers of France, swindling the government in custom duties on her return to this country is a pathetic instance which

[1] *Memories*, by Edward Clodd, p. 129.

can be duplicated many times during the year from the daily press. Perhaps the most conspicuous example of the present day is that of those business men who give generously to the poor and to the service of the nation, yet take advantage of war conditions to rob the people collectively by hoarding and overcharging. Preventing collision between conflicting ideas keeps the mind at peace, but thinking is negligible in such placid states. Viewing questions from different sides so as to see their meaning and their relation to other problems, if done ingenuously, is likely to produce some mental perturbation, but the rearrangement of ideas that follows the agitation is quite certain to clarify the judgment.

Sometimes the inability to see the "other side" assumes a humorous aspect. When, for instance, after a long friendship, politics estranged Felton and Sumner, the latter wrote: "In anguish I mourn your altered regard for me; but, more than my personal loss, I mourn the unhappy condition of your mind and character."[1] And Carlyle, opposed to evolution, once said of Darwin: "A good sort of man is this Darwin, and well meaning, but with very little intellect."

Here, again, we come upon another characteristic of human nature, illustrative of fixed opinions, and that is that *prejudices grip us unawares*, and we go on serenely in the happy belief that we *think out questions* and settle them by the reasonableness of the arguments. We have observed, however, that man does not think as much as he fancies he does. Prejudice is a habit of thought, and a habit of thought, as we shall see later, is a physiological matter—the tendency of nerve impulses to follow old, well-worn paths. Habits are physical conditions, like the tendency of a book to open to the place to which we frequently turn, and it is quite as difficult for man to break

[1] *Memories and Letters of Charles Sumner*, by Edward L. Pierce, vol. III, p. 220.

an established habit in himself as it is to change the habit of the book. We grow into most of our ideas wholly unconsciously. This is because we always hear them uttered by the people who mingle in "our set."

Our environment is full of problematic relations inadequately solved because they are not understood. And they are not understood because of the prejudices of our mental complexes. The relation between capital and labor is an illustration. Many men are not even aware of the existence of some of these problems. Habits of thought and action usually embrace the range of behavior so completely as to leave the narrowest margin for variation, and then only in matters of detail which have no significance for progress. The result is that progress, both in the individual and in the race, is a series of blunders, each subsequent act being directed chiefly at mitigating the mistakes of earlier ones. This is the animal method of trial and error, with apparently little more conscious mental prevision of the probable outcome of acts than is found in the lower animals. If this statement seems too strong let the reader study the history of the conservation of our natural resources, the granting of city franchises, the control of public-service companies, or of corporations of a semipublic character. The pension system has not yet reached the stage of correcting past errors. It still continues a colossal blunder.

The resistance to clear thinking by fixed opinions and habits of thought raises the question of their cause. We have already mentioned one—the environment in which we live, the influence of early education and social pressure. But there is another, and that is the subtle effect of phrases.

Man deals largely in phrases—in word formulas. If we hear a phrase often enough we come to think we see meaning in it, however senseless it may be. This tendency to accept vague phrases is utilized by politicians, and not

infrequently it is the reason for the success of a party at the election. Party slogans, to which we have already referred, by no means exhaust the list of ingenious political thought-controllers; and advertising experts who can coin phrases are in great demand. This method of directing thought into prescribed channels and damming it up by appealing to human emotions and prejudices is so effective as to constitute at times a social menace. Illustrations of phrases with carrying power, such as "the rights of man," "personal liberty," the "big cinch," and the "medical trust," might be continued almost indefinitely. They all beg the question, but they beg it convincingly. To accomplish their purpose the phrases must be suggestive, but they must also be vague enough to enable different people to put their own interpretation into them. Acceptance of such word formulas promotes and perpetuates prejudices by obscuring the content, or lack of content, of the phrases. The habit of not examining critically the phrases that we hear and use cultivates loose methods of thinking.

Arnold Bennett's *Clayhanger* contains an excellent illustration of the effect of a word. Speaking of the candidacy of Mr. Bradlaugh for the House of Commons, one of his characters says: "It was not easy—at any rate it was not easy in the Five Towns—for a timid man in reply to the question, 'Are you in favor of a *professed* Free Thinker sitting in the House of Commons?' to reply, 'Yes, I am.' There was something shameless in that word 'professed,'" continues Mr. Bennett. "If the Free Thinker had been ashamed of his free-thinking, if he had sought to conceal his meaning in phrases—the implication was that the case might not have been so bad."

Phrases cleverly worded to appeal to moral sentiments, and to feign an open-mindedness which their writers do not have, illustrate this power of empty words to cajole the human mind into placid assent in the conviction that

it is thinking. The form of a statement with carrying power varies, of course, at different periods. We do not, as formerly, say, for instance, that Job's distemper was smallpox, and that he was probably inoculated by the devil, nor do we assert that the practice of vaccination is "flying in the face of Providence" and endeavoring to baffle a "divine judgment," but we still hear that vaccine is poison, and the influence of this word is still further strengthened by the addition of the disagreeable phrase "putrescent matter." The fact that the prejudice against vaccination continues in spite of the evidence in its support shows the mystic power of a vague, unanalyzed word and phrase to stifle thought. The titles of a few pamphlets against animal experimentation which the writer has recently received are worth quoting as additional evidence of the subtle effect of language in narcotizing reason.

You will observe that, as was the case with "putrescent matter," the words used in these titles are disagreeable words—words that at once stir our indignation and so arouse prejudice against the acts which the writers are opposing. This is good psychology, but bad ethics. The following are some of the titles. *Shall Science Do Murder?; Confessions of a Vivisector; Anæsthetics the Greatest Curse to Vivisectible Animals; Awful Vivisection of Horses; The Reality of Human Vivisection.*

Naturally, any subject of study that instigates murder, or group of men who commit the crime, must be *bad*, and *confessions* always carry with them the idea of sin. And further, the vicious depravity of those who indulge in the "awful vivisection of horses" and in "human vivisection," goes without saying. The success of such titles is an excellent illustration of the convincing power of words.

The last of these pamphlets to which I wish to call attention carries the psychologically effective title: *Is Christian Mercy a Cruel, Mocking Delusion?* This pamphlet asks: "Can the church allow this deadly moral venom,

distilled by vivisectors in their laboratories of scientific research, to poison the spiritual atmosphere of the souls Christ died to save?"

The expression, "this deadly moral venom," is bad enough to convert any one to the doctrine of antivivisection, and hence, if one has no respect for truthfulness or for the English language, its psychology is unimpeachable; but when, in addition, we learn that this "moral venom" is "distilled by vivisectors in their laboratories of scientific research to poison the spiritual atmosphere of the souls Christ died to save," surely, we must conclude that no dungeon or torture is adequate punishment for the distillers!

The soporific effect of such phrases upon thought is a national menace to-day when animal experimentation is needed to investigate the medical and surgical problems of the new methods of warfare. While our young men on the battle-front of Europe are dying from new and obscure diseases, antivivisectionists are striving to stifle the investigations which must be made to combat successfully the new conditions and save the lives of our soldier boys. "Shock," "trench fever," "trench foot," "trench heart," "trench nephritis," and "shell shock" have never been met before, and each new poisonous gas requires separate experimentation upon the lower animals that its effect and cure may be discovered.

We have said that understanding the problem and getting the facts are the beginning of thinking. This method is also the best antidote for mental numbness produced by phrases. Let us therefore examine some of the facts that show what animal research has accomplished. If these facts prove that human life has been conserved and suffering relieved by animal experimentation, then the problem is simplified and resolves itself into the question whether men and women, and boys and girls are more important than dogs, rabbits, guinea-pigs, and monkeys.

Besides showing the importance of facts, this reduction of a complex problem to a simpler one by eliminating unessentials illustrates a method of clarifying thought. All of the knowledge to which we shall briefly refer has been obtained by experimenting upon the lower animals, and could have been gained in no other way.

The mortality from wounds of the stomach during the Civil War has been estimated as high as 99 per cent. To-day "no complications ought to occur, save in exceptional cases." Doctor Keyes reports[1] a recovery after twenty-two gunshot perforations of the bowels. And this change would have been impossible without antiseptics discovered by experiments on the lower animals. Surgery of the chest, also, has been revolutionized. And as for surgery of the heart and arteries, a wholly new chapter has been opened. Suture of blood-vessels, end to end, as done to-day through the skill gained by experiments on lower animals, not only avoids the clot that in earlier attempts obstructed the flow of blood, but, in addition, this same method permits the transfusion of blood, an operation altogether impossible until many experimental trials and failures upon the lower animals finally achieved success.

Tumors and abscesses inside the skull can now be located and frequently, in the one case removed, and in the other drained and cured. Tissues can be transplanted and made to grow, and, as is well known, with the skin this is now a simple operation. Serums have been discovered for epidemic cerebrospinal meningitis, tuberculosis, diphtheria, lockjaw, and typhoid fever. In the United States, before the use of the antitoxin over 120 out of each 100,000 inhabitants died yearly from diphtheria. To-day the death-rate is about 27 in the same number of inhabitants, and some of these could doubtless be saved were the serum discovered by animal experimentation used in time. Lockjaw is now almost unknown because of the use of its antitoxin.

[1] *Journal of the American Medical Association*, 1912, p. 1886.

As for typhoid fever, it afflicted nearly one-fifth of the entire army of the Spanish-American War. "It caused over 86 per cent of the entire mortality of that war," and the surgeon-general's report for 1916 says that the mortality from this disease during that year was three-tenths of one per cent for the entire army, regulars and national guard. Typhoid has ceased to be a scourge to the army; and this change has been brought about by animal experimentation.

We have dealt at some length with the evidence for the value of animal experimentation to show the array of facts available for those who are interested in thinking this question out rather than in justifying a settled belief. Yet we have only scratched the surface of the proof.[1] And the cry of opposition is not stilled. Even so clever a thinker in some matters as Agnes Repplier cannot avoid a rhetorical fling at this form of experimentation.[2] The explanation of the opposition of intelligent men and women is that frequently the emotions overbalance the intellect, and for such people facts have no meaning. They cannot understand and interpret facts because the emotional resistance dulls their critical judgment.

Another effect of this emotional debauchery, aside from its extinction of thinking, is its moral influence upon those who indulge in the spree. It is not uncommon for antivivisectionists, for example, in quoting from the writings of experimenters, to omit the portions that would deny the statements and conclusions which the antivivisectionists wish to give. And, again, the following by Mary Alden Hopkins, taken from *Four Lights*,[3] the organ perhaps of the People's Council of America, since they sent it to the writer, illustrates in another way the same mental and

[1] Those wishing fuller information should consult *Animal Experimentation and Medical Progress*, by W. W. Keen, Boston, 1914. See also *Medical Research and Human Welfare*, Boston, 1917, by the same author.

[2] Signed article in the *New York Times Magazine*, Nov. 11, 1917.

[3] August 1, 1917.

moral obliquity. "Accustom your children gradually to the sight of blood," the paragraph begins, presumably representing the view of those who believe that war is ever justifiable. "And for yourself learn to kill a little every day. One sweet woman is accustomed to ask herself searchingly each night, 'Whom have I killed to-day?' and to fall asleep resolving to kill more on the morrow." Could there be a more charming case of moral perversity than is shown by this characterization of those who believe in fighting to preserve democracy? And what chance have thoughts—thoughts that lead to a valid conclusion—in this emotional vortex? A hopeless argument destroys the moral perspective.

Another source of error in much of our reasoning is man's inclination to decide the worth of ideas by the consequences which he thinks will ensue. We picture direful results and condemn the idea. Voltaire, for example, was so fearful lest the discovery of fossil fishes in the Alps would support the Biblical account of the deluge that he at once seized upon the first (and most ridiculous) explanation which could be offered, *i. e.*, that they were the remains of fishes brought there by pilgrims.

Two things may be said about judging ideas by their results: First, that the consequences which we fear may not follow, and second, that if they do they may not be as bad as we anticipate. Imagine what the men of the feudal period would have said had the plan been proposed of intrusting the protection of their estates and lives to a body of paid public servants, *i. e.*, policemen. This judging by consequences was the chief reason for the opposition to evolution. It was predicted that it would destroy religion and morality. The battles which were waged around Darwin's *Origin of Species* are among the fiercest and least intelligent in the long, cruel warfare against prejudice. So far as evolution is concerned, the war has been fought and won, and the result is a higher

conception of religion and morality. Josh Billings, in his quaint way, expressed his opinion about those who are so sure of the disasters that will follow the acceptance of new ideas when he said: "'Tain't what men don't know that makes trouble in the world; it's what they know for sartan that ain't so."

It is doubtful whether prejudices diminish in number with the advance of civilization. They simply vary in kind, and this is one of our mental handicaps. Man thinks that he is progressing merely because he has thrown aside some ideas which were in vogue fifty years ago. It is easy to see prejudice in the thoughts and beliefs of earlier periods because they stand out in contrast with the background of modern knowledge; but the prejudice in beliefs which are fashionable to-day is not so easily detected. It is like our judgment of the oddity of clothes. We see the faults of the crinoline, especially, for instance, when we think of the wearer in connection with our crowded street-cars, but it should relieve us of at least a modicum of conceit when we reflect upon the probable remarks on present styles fifty years hence. And the same may be said of ideas and beliefs.

The opposition to current social, industrial, ethical, and political innovations seems almost axiomatic because the prevailing ideas appear so self-evident. Besides, as has been said, we like to feel that questions are settled. Sometimes we fear that doubt will give the appearance of vacillation. So we classify ideas under headings, and when our opinion is asked we need only refer to our mental card catalogue of right and wrong, anarchistic and socialistic acts or opinions, and the question is decided. We are like those who tie up clothing in bundles and untie these later only to take out a lot of antiquated goods. The difference is that we ourselves do not see that our ideas are out of date. Only those who have resisted the desire to preserve the old are aware of that. One of the sad facts in human

psychology is that man grows old mentally long before his years warrant his antiquity.

Illustrations of man's failure to think have been drawn largely from science because it would seem as though here if anywhere open-mindedness might be expected. Yet we have not found it so. In emotional questions, such as industrial problems that affect our business interests, and religion which draws its inspiration from our deepest instincts, the path of truth is strewn with the débris of personal interests and tradition. It is here even more than in science that we need to-day above all things, as Alice Freeman Palmer once said, "The influence of men and women of generous nature, of hospitality to new ideas; in short, of social imagination."

The mental attitude is often the deciding factor in thinking. There are those who revel riotously in the obscure. They want to believe in "new thought," "metaphysical healing," clairvoyance, second sight, animal magnetism, etc., and so they readily find evidence. Proof of what we wish to believe is easily obtained. Obscurity sounds like concealed wisdom to the credulous. The literature of the occult is loaded with meaningless phrases which the devotee believes will yield thought if only he can break through the outer crust and absorb the nectar of truth. About fifty men and women from one of the largest cities in the country recently took a course in "Where Dwells the I Am," under the direction of the high priest of the cult. I quote a sentence from one of the books that answers this question.

"Through involution we are carried back to the nativity or primary life through material form, which is the first expression of love through earth form or upon this earth plane." These men and women were studying this drivel in the belief that its profundity obscured the meaning, and that the significance would be clear if they would but repeat it times enough. And they were right, at least so far as seeming to see meaning in it is concerned.

It is characteristic of the human mind to be attracted and impressed by the unusual or sensational, and to fail to notice events that are daily occurrences. Now, it is true that exceptional instances have played a tremendously important rôle in the progress of science. There is nothing mysterious about routine events. The myriads of stars in apparently fixed relative positions and visible every night had less popular and scientific interest in the Middle Ages than two brilliant stars that suddenly shot into view and almost as quickly disappeared. One of these, indeed, started Tycho Brahe in his remarkable observations and investigations. But when the scientist is attracted by the unusual his interest quickly centres in its relation to the more common. The brilliant temporary star observed by Tycho Brahe interested him only as it suggested problems about the stars which had previously attracted little attention. If it were an exception to the usual, then the usual was not understood. A law of nature can have no exceptions. Consequently, the scientist investigates the uncommon that he may understand the common.

The public, however, is attracted by the unusual for quite a different reason. Like the scientist, they assume uniformity and consistency, but they attain it by predicating some new force or cause as an explanation. A man's dog does remarkable things—much more remarkable than the accomplishments of your dog or mine—but these exceptional actions are easily explained. His dog reasons. Quite likely yours does not. At any rate, he is altogether willing to grant you that it does not; but his does. There is no attempt to carry uniformity beyond his own pet. In the same way believers in thought-transference or in the prophetic value of dreams will narrate wonderful cases which have come within their own experience. No attempt is made to bring these exceptional cases into conformity with matters of common experience. It is sufficient that a name be given to explain them. Examination would frequently show that they were not even exceptions

in any other sense than that they had attracted an exceptional degree of attention. A "psychic," for instance, informed the writer some time since that she had a premonition that her brother in Mexico was in trouble. Now, it so happened that at that time the continuous revolution was in progress in Mexico and everybody there was in trouble. A little reflection will convince the reader that if the merest fraction of his premonitions had come true he would be a raving maniac.

There are various reasons for making the exceptional the standard. The unusual attracts our attention not always because it is striking and sensational, but sometimes because of its effect upon us. "It always rains when I do not take my umbrella" is almost proverbial. As a matter of fact, if one were to record the days when one carried an umbrella or failed to do so, with a note for each day regarding rain, the statement would be found to be incorrect. The occasions on which I am caught in the rain without an umbrella are impressed upon me because I spoil a new hat, or I am seriously irritated by the rain in some other way. On the other hand, the days when I do not take my umbrella and it remains pleasant leave no impression. They are forgotten because nothing happened that forced me to think the two facts together.

In the case of the umbrella, thinking is obstructed because we forget the favorable and remember the unfavorable, but in another class of events the reverse is true. There is no contradiction here, however, since in both cases the reason for remembering the things that confuse thinking is the impression made, which in the case of the umbrella was caused by irritation and in the other by pleasure and hope. An illustration of the latter is quacks and prophets who thrive on the psychological effect of occasional successes among numerous failures. Clairvoyants arrested in Chicago said on the witness-stand that clients came in such numbers that they could not manu-

facture prophecies fast enough to meet the demand. "Men mark when they hit and never mark when they miss," Bacon said; and it is true of the hits and misses of others when the hits coincide with our wishes. But it was a wise old Greek who, when shown the votive offerings to Neptune of those who had been saved from shipwreck, cried: "But where are the offerings of those who never returned?"

The 1917 mayoralty campaign in New York City, to illustrate from another angle, has proved again what has been observed repeatedly, that only the unusual—sensational—in municipal administration attracts the attention of voters. The public is indifferent to the quality of government unless intolerable scandals are disclosed. They are interested in turning rascals out, but not much concerned with retaining good officials. Good government is uneventful. Nothing strikingly unusual happens. So the attention relaxes. Probably Mitchel's administration was the best that New York has ever had, but there was nothing extraordinarily impressive to compel the attention to note its quality. Hence, reasoning, on the basis of the results produced, was defective.

The tendency to fix the attention on the unusual reaches widely into events because, in some way or other, many of them affect our weal and woe; and in attending to two events, one of which follows the other, man, as we have seen, is prone to assume the operation of a force to bring about the conjunction. This, of course, vitiates his thinking. The connection supposed by many to exist between the phases of the moon and the sowing of crops is an instance. A more common illustration to-day is the belief in some relation between the phases of the moon and rain. "It will not rain until we have a change of the moon" is a frequent statement. The truth in this probably lies in the fact that people do not begin to talk much about the weather until the condition is somewhat threatening. By

that time rain is due, and in localities in which the prospect of rain is sufficient to warrant its discussion the chances are pretty good that it will come within, say, a week. By that time the moon has changed and the connection between the two events is settled to the satisfaction of those who are looking for that sort of cause.

Thinking, then, briefly to survey the field, requires that, first of all, the trouble be located and defined. In intellectual matters this usually means a clear statement of the problem to be investigated. It must be freed from all unessential accretions—isolated from the incidental factors associated with it. These accidental adhesions confuse the issue and derange thinking. After the problem has been clearly stated we are ready to get the facts. Everything bearing on the difficulty should be ascertained. Darwin's method indicates the numberless facts, days, and years sometimes needed.

"When on board H. M. S. *Beagle* as naturalist," he says,[1] "I was much struck with certain facts in the distribution of organic beings inhabiting South America, and in the geological relations of the present to the past inhabitants of that continent. These facts, as will be seen in the latter chapters of this volume, seemed to throw some light on the origin of species—that mystery of mysteries, as it has been called by one of our greatest philosophers. On my return home it occurred to me, in 1837, that something might perhaps be made out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years' work I allowed myself to speculate on the subject, and drew up some short notes; these I enlarged in 1844 into a sketch of the conclusions which then seemed to me probable; from that period to the present day" [1859] "I have steadily pursued the same object."

Not until facts have been accumulated and ordered are

[1] *Origin of Species*, Introduction.

suggestions that are worth while likely to appear. Knowledge gives the raw material for solving problems, but in addition to knowledge there must be a sensitive, open mind anxious to see things as they are, instead of as we should wish them to be. While Newcomen was working on the engine which bears his name he noticed that the piston gave several strokes in unusually rapid succession. On searching for the cause he found that a hole in the piston let the cold water pass into the cylinder and thus caused a rapid vacuum. A thought suddenly flashed into Newcomen's mind, and internal condensation by means of a jet was the result.

Naturally, Newcomen had no emotional bias, but many questions, especially those of a social and industrial nature, cut deeply into our personal interests and desires. We therefore stress unduly certain factors and ignore others. Partly for this reason thinking is diverted into wrong channels and, at times, it is completely blocked. Again, man, for reasons lying far back in his past, tends to assume certain relations between events. It is, therefore, necessary to be continually on guard against diverting and perverting influences upon the course of thought; for only by the utmost watchfulness can a problem be kept clear of unessential and human factors. And we should never forget that "Cultivation," as Samuel Butler has said, "will breed in any man a certainty of the uncertainty of his most assured convictions."

CHAPTER III

HABIT IN PREPARATION FOR EFFICIENCY

WHEN we observe an animal or plant we are impressed with the similarity of its life from day to day. It does much the same thing under essentially the same conditions. The root of a plant always grows down into the earth and the stem seeks the light; cats mew beseechingly at the sight of milk and spit when a strange dog appears; and a man awakens at about the same time every morning, eats much the same things for breakfast, reaches his office at the same hour each day, and begins his work in the serial order of yesterday. The reason for this similarity of action is habit.

As was pointed out long ago by various writers, habits are the result of changes in matter. It is because of this that we sometimes speak of the habits of plants. Indeed, one may go much further and refer to the "habits" of non-living matter. Shoes, for example, are more comfortable and flexible after having been worn for a few weeks, and the wood of a violin of an old master has acquired "habits" of vibrating that make it a more sensitive and delicate musical instrument.

It will be observed that in some of these instances the changes are, in a sense, external. The creases of the shoes that make them more comfortable are visible. The alteration of the wood of the violin, however, is invisible. As a result of the skilful playing of the master the wood has acquired certain vibratory tendencies. It has become more flexible in certain ways; it responds more delicately to touch. To be able to adapt itself to new conditions—to have the capacity to change, the ability to adopt new habits—a substance must be flexible enough to alter its

form or its structure without losing its integrity. It must not go to pieces. Substances which have no plasticity or which break under alteration cannot acquire new habits.

We are not accustomed, however, to speak of these responses of non-living matter as habits. Neither do we usually apply the word to the actions of plants. The term has been reserved for the relatively settled ways of behavior of animals—modes of action which have been acquired during the lifetime of the individual. Habit is thus distinguished from instinct. If we put it a little more technically, habit is a relatively organized and fixed nervous process, or series of processes, acquired by an individual, the repetition of which results in greater facility and better accommodation to the conditions that start the process. Objects and animals alike offer resistance to modification—to change; and, when the change has taken place, the new arrangement acquires a permanency of its own. It has taken on new habits and again it resists alteration.

The justification for making habit analogous to the behavior of plants and the action of non-living matter is found in the fact already mentioned that habits are the result of changes in matter. A sprained arm, for example, is ever sensitive to strain. Some persons, again, are prone to sore throat, bronchitis, or tonsilitis. The tissues may be said to have the habit of easily becoming irritated. Functional diseases, again, are due to a predisposition of certain organs to function abnormally, and in such cases the purpose of medicine is to establish correct "habits" of action. "Tapering off" is another illustration. The purpose of this treatment is gradually to overcome old habits by starting and strengthening new ones.

If we ask how habits are formed in animals we must turn to the nervous system for the answer. Nervous impulses started through the eye, ear, or other sense-organ run their course. They must find an exit; and their exit

results in an adaptive response—in behavior of some sort—to an external situation, perhaps to an emergency. These nervous impulses in their course leave traces behind them. Some alteration occurs in the path which they have taken because of their passage over the route. There is some kind of a change in the nerves or in the connections between the neurones, by which a path once traversed is opened, and consequently offers less resistance to the next nerve-impulse that seeks an exit. What is this change? We do not know definitely, but the indications are that it is of a chemical nature. At any rate, a path once traversed by a nerve-impulse becomes an available outlet for succeeding ones, and a habit is thus established.

Psychologists speak of "paths" being formed in the nervous system, and being made more easily traversible by the repeated passage of an impulse. This, of course, is an analogy, and analogies are likely to be misleading. But there seems to be truth in Carpenter's statement that an organ grows "to the mode in which it is habitually exercised." This is the case with muscle, as is seen in exercise, and there is no reason why it should not be true of the nervous system. Reconstructive changes are always going on, and these changes tend to emphasize and "fix" the sort of functional activity prevailing for the time. It is an instance of organic adaptation to demands. Exercise builds up muscle and lack of exercise is attended by gradual deterioration of the tissue.

Activity always breaks down tissue which must be restored that the organ may not lose its power to function. This restoration, however, does not reinstate the original condition of the organ, for if it did the strengthening of a muscle would be impossible. The reconstruction is rather an adaptive process that tends to meet the demands put upon the organ, and in a nerve-unit this demand is for continued and improved accessibility to nerve-impulses that reach it over a previously travelled route. The need

for an uninterrupted course exists, and the claim is made upon a particular nerve-unit because the path has already been traversed. In this way nutritional reconstruction of a neurone whose elements have been depleted by the passage of an impulse tends to conform to the demand of other impulses for free passage.

If we inquire why the nerve-impulse first took the path which began the habit, perhaps the most that can be said is that there was no special reason why it should not. For reasons hidden in the structure of the nerves, or their connections, it was at the moment the path of least resistance, and there was no urgent need for taking another course. A man, for example, has rented a house in the middle of a block. The first time that he starts for the street-car he may turn to the right or to the left. Both cross-streets are equally near to his house and to the car. He does not know why he took one rather than the other, but the first act establishes the habit and, except for special reasons, he will always follow the same route in the future.

We are now able to state the first practical advantage of habit and also to show its evolutionary significance. *Habit makes movements exact and "sets" them, and it lessens fatigue.* One need only watch a child who is learning to dress himself try to button his clothes to see the advantage of this. If movements once acquired by practice were not "set," learning acts of skill would have no meaning. It would be necessary continually to repeat the trial-and-error method, and man would have no time for anything beyond the simplest, most elemental needs of existence.

The lessening of fatigue in habitual occupations is quite evident in physical labor. The bricklayer is unfatigued by his day's work, and the store clerk stands or walks about for ten or twelve hours with ease, but let these men exchange occupations and both are exhausted at the end. This is not merely a matter of muscles. The nerve centres and synapses—the functional connection between

nerve-units—are factors in even "muscular fatigue." It is much the same with mental activity. An accountant ends the day as fresh as the department manager, but neither could do the other's work without exhaustion at the close of day. In all of these cases it is habit that makes the work endurable—habits of muscles, of nerve-connections, and nerve-centres.

The same reason that makes a change of occupation fatiguing applies in adopting a new method for the same work. Subjectively the resistance of the nervous system to an altered response may have all the signs of fatigue. Yet in many instances this feeling of weariness expresses the organic reluctance to drive through the first line of trenches, to overcome the first resistance; and it is because of this characteristic of the nervous system that what we have called the *tendency to minimum effort* prevails. Energy is required to overcome this inertia and the effort is not easily made. When once the habits that constitute the revised action are established everything again runs smoothly.

The advantage of habit is the exactness of automatized movements, and its evolutionary explanation is the need of meeting emergencies in a definite manner. Having found a successful reaction, the act once performed becomes the line of least resistance. In the species, habit represents the prudent, "safe" manner of behaving. These "habits" of the species, however, are deeply ingrained in the organism and are called instincts. They are necessary for survival and have been established by the elimination of those individuals who did not conform.

Man tends to do things in the simplest way, in the way that requires least expenditure of energy. "No one, not even a child, likes to take unnecessary trouble," was one of Rousseau's keen observations; and habits are trouble-savers. A certain result is desired, and we have found that only so much energy is expended as its attainment

requires. Illustrations in daily life are common. Professional and business men wish to achieve a certain end. The goal is variable. "Success" has no absolute measure. Consequently, the methods that secure fair results are continued, and habits are formed. Change of habit is always accompanied by a mental wrench. One's mind seems out of gear. Reactions do not run off smoothly. The habit of taking exercise, or of not taking it, and of the gait in walking, are illustrations. A man unaccustomed to regular exercise cannot break away from his office, and business habits are difficult to change for exactly the same reason. The nervous impulses are accustomed to take certain paths, and when they run through these there is less resistance than when they take a new course.

New paths, however, may be opened and two or more opposing habits may be brought to such a degree of perfection that each will function without interference from the others when once the cue is given. Let us turn for a moment to some of the experiments which have shown this. It will then be easier to estimate the larger significance of habit. Münsterberg[1] tested the persistency of habit in two ways. He was accustomed to carry his watch in his left vest-pocket, so he changed it to his right trousers-pocket and noted the number of false movements. After a month had passed and he had acquired the habit of immediately putting his hand into his right trousers-pocket when he wished to ascertain the time, he replaced the watch in his left vest-pocket. He found that it required considerably less time to relearn the old habit than it had taken to accustom himself to the pocket of his trousers. Traces of the old habit therefore remained. He then alternated the use of the pockets and observed that the time for each relearning grew less until, after the third change, he could use either pocket without making any mistakes.

He then tried a similar experiment with the inkstands

[1] *Beiträge zur experimentellen Psychologie*, 1892.

on his desk, filling first one and then the other and noting again the number of wrong movements. Finally he tested himself in using two doors leading from his office to the corridor. The one not in use was kept locked. The result of these experiments was essentially the same as with his watch; traces of the old habit remained and resisted change, but it was easier to relearn the old than to learn the new, and finally he could make the right movement, whichever it might be, without interference from the opposing habit. Münsterberg therefore concluded that a given association —or habit—can function automatically while some effect of another, opposing, association remains.

Repetition of Münsterberg's experiments, in Washington University, by members of the class in psychology, indicated that somewhat less time was required than he found to break the simple habit of taking knife, keys, or watch from a certain pocket. From two weeks to sixteen days were needed to reach the first errorless day in the establishment of a new habit.

Bergström[1] tested the effect of interference of previously formed associations (or habits) in sorting cards. He found that "the false movements" [in sorting the pack in a new order], "the errors which the subject was obliged to correct, and the consequent retardation, show that a strong association had been formed. . . . It is a mechanical struggle of habits." From his second study Bergström concluded that the effect of the interference of an association (or habit) partly established is equivalent to the practice effect. The earlier habits therefore persist. They have not been effaced.

Müller and Schumann[2] experimented with nonsense-syllables. They stated their problem as follows: "When a series of nonsense-syllables has been learned until it can be repeated once without error, and is then relearned to

[1] *American Journal of Psychology*, vol. 5, p. 366; vol. 6, p. 433.
[2] *Zeitschrift für Psychologie und Physiologie d. Sinnesorgane*, vol. 6, p. 173.

the same extent after a certain interval, will more repetitions be required if in the meantime the syllables have been associated with another sort of syllables?" These experiments indicated considerable interference in the relearning, because of the disturbance caused by the secondary associations. In other words, an incipient habit asserted itself.

Bair[1] attacked the problem of interference from habit, among other ways, by using a typewriter. The keys were associated with definite colors. He found that the difference between two opposing habits grew less the more automatic the two responses became, and finally, after both sets of reactions were practised to perfection, the interference disappeared. This agrees with Münsterberg's conclusion that two opposing habits may be made so automatic that conflict disappears when they are alternated.

The typewriter and sorting of cards were used by Culler[2] in his experiments. The keys of the typewriter were numbered and certain fingers were habituated to the different keys. Later, different fingers were used to strike some of the keys, and the interference was noted in the additional time required for the writing. Culler's conclusions may, perhaps, be best given in his own words:

"When two opposing associations, each of which excludes the other, are alternately practised with one, four, or eight repetitions of each association before the other is resumed, the opposing associations have an interference effect upon each other in all" [persons]. "The interference effect grows less and less while the practice effect becomes greater. The interference effect is gradually overcome, and both opposing associations become automatic, so that either of them can be called up independently without the appearance of the other. . . . When a change in reaction to several of a series of long-practised stimuli is introduced,

[1] *Psychological Review Monograph Supplement*, no. 19.
[2] *Archives of Psychology*, no. 24.

as in the typewriting experiment, there is great immediate interference effect. This is shown by the increase in time and the recurrence of the former associations. . . . An error committed in practice tends to introduce interfering associations which will cause other errors. In some cases this interference has a general effect which causes various errors; in other cases it has a specific effect which causes a repetition of the error in succeeding trials."

The last investigation of this subject which we shall cite was again an experiment in sorting cards in two different orders. In this investigation Brown[1] found that interference manifests itself to the detriment of success in trying to learn to sort the cards in two different ways. In beginning either of the two methods of sorting there was clearly loss of speed, due to the tendency toward conflicting movements, and interference was also indicated by increase in the number of errors. Errors always increased when the order in which the cards were sorted was changed, and those who were most disturbed made the larger number of errors. Brown observed, however, that as the work proceeded practice in one order helped in learning the other. So learning to do a thing in two different ways need not be detrimental. This agrees with Bair's conclusion that if a series of reactions is well learned this practice promotes learning a new arrangement of the series.

This experimental evidence that two opposing habits may operate alternately does not refute what has been said about their dominating power. The experiments show that habits are closely isolated processes. Start one habitual series, and it runs its course. Start another and it does the same, even though there are elements in the two that conflict with one another. Habit clearly persists, delaying and disturbing opposing reactions, but when two conflicting habits have become automatic, interference

[1] Warner Brown, *University of California Publications in Psychology*, vol. 1, no. 4.

between the two disappears. In acts of skill the sensation caused by a muscular contraction starts the next movement in a habitual muscular series.

This is the explanation of complex acts involving many simple movements. If one thoroughly masters a typewriter with one arrangement of the keyboard, before beginning on another with a different keyboard, for example, there is not only no interference between the two sets of habits, but the second one may even be learned in less time than was needed for the first. After the second has, in turn, become automatic, the two may be alternated without conflict between the two sets of habits. In the same way, if one is studying different theories regarding some scientific or social phenomenon, there will be interference between the two views and one will remember neither accurately unless the first is thoroughly mastered before the second is studied. After the first is understood and learned, the second will cause no confusion, and if each is made automatic there will be no difficulty in recalling either or both.

Habits in individuals are practically inevitable reactions to surrounding conditions. In a very real sense they are personal reflexes. Aside from the automatized movements of which we have just been speaking, they show themselves in social mannerisms, in ways of talking, even to the words used, in the manner of walking, and in general in the mode of behaving. Families, schools, colleges, business houses, all have their peculiar habits, represented in the similarity of behavior of their members.

The daylight-saving plan is an excellent illustration of public recognition of the irresistible force of habit. People cannot change their habits of rising and beginning their work by the clock; so the clock is set ahead an hour, and then everything works smoothly. It is a deliberate self-deception by which a whole city intentionally tricks itself into rising, working, and retiring an hour earlier *by the sun.*

The habits of the people are not disturbed, because they do everything at the same hour as before, *by the clock.*

Habit is evidently a tremendous force which must enter into our computation of problems of human behavior. The long discussion about setting the clock ahead—it has now continued over two years—shows that our custom must not be disturbed. When we look at our watch preparatory to leaving the office, the time indicated should be the hour at which we are wont to leave. We must not be obliged to reflect upon whether we will leave an hour earlier than has been set by habit. If the routine is not disturbed the usual series of acts for that hour will run its course and the desk will be closed.

We have said that habit makes movements exact and "sets" them, and that it lessens fatigue. We are now ready to state its second practical advantage. *Habit first reduces and then eliminates the attention with which acts are performed.* These acts will then become essentially reflex. Automatic actions and the handicrafts afford the best illustrations of this advantage. So helpful is absence of attention to automatic acts that when it is given to them they are disturbed. It is a matter of common knowledge that attention to our manner of walking across a ballroom makes our gait awkward. This has been illustrated in one of those little doggerels that so often represent the psychological observations of the layman:

"The centipede was happy quite,
Until the toad, in fun,
Said, 'Pray, which leg comes after which
When you begin to run?'
This wrought his mind to such a pitch,
He lay distracted in a ditch,
Uncertain how to run."

In the handicrafts, also, skill is not associated with attention to the delicate muscular movements, and the impor-

tance of habit in the moral and social virtues is too well known to require extended discussion. A recent report from an unexpected source, however, adds greatly to the significance of ethical, social, and industrial habits. A committee of the Society for the Promotion of Engineering Education estimated the relative importance of the various factors that make for success in engineering.[1] Over 5,000 practising engineers participated in the investigation, and knowledge of fundamentals and technic was rated at about 25 per cent. The remaining 75 per cent was accorded to various qualities into which habits of one sort or another enter. It has long been observed that engineers, when selecting young graduates for their employ, inquire quite as much whether the applicants are leaders in college and in social service as about their technical qualifications. They want subordinates who have acquired habits of leadership which will fit them to handle men; and they are of the opinion that these useful habits, if they are foreign to the earlier life of the young men, cannot be readily adopted in the course of the work. Ethical habits are evidently quite as significant for efficiency as those that are physical.

Childhood and youth are the periods for fixing both intellectual and ethical habits. If a boy of seventeen has not learned that accurate facts are essential to correct reasoning, if he does not know the difference between facts and assumptions, it is doubtful whether he will ever make the discovery and acquire the habit of investigating; and in adult life, to turn briefly to the ethical side of the subject, one cannot successfully adopt manners and forms of behavior to which one has been unaccustomed earlier in life, cannot give the appearance of having been to the manner born. The efforts of the *nouveaux riches* to simulate refinement, for example, would be pathetic did not their contentment with the grotesque result give a touch

[1] *Engineering Education*, vol. 7, p. 125.

of humor to the outcome. Dress, manners, and house furnishings all betray the humble origin, which is made vulgar by the attempt to conceal and forget it. Early habits of primitive taste and behavior are too firmly rooted to be eradicated. And one proof of this is the gratification of these people with the result. Not the slightest doubt of success clouds their satisfaction.

Some people, on the other hand, in adult life become aware of the terrible handicap of habits against which they are struggling. "Could the young but realize," says James,[1] "how soon they will become mere walking bundles of habits, they would give more heed to their conduct while in the plastic state. We are spinning our own fates, good or evil, and never to be undone. Every smallest stroke of virtue or of vice leaves its never-so-little scar. The drunken Rip Van Winkle, in Jefferson's play, excuses himself for every fresh dereliction by saying: 'I won't count this time!' Well, he may not count it, and a kind Heaven may not count it; but it is being counted none the less. Down among his nerve cells and fibres the molecules are counting it, registering and storing it up to be used against him when the next temptation comes. Nothing that we ever do is, in strict scientific literalness, wiped out." So strong is the grip of habit. Success or failure in life is being settled before the boy and girl are old enough to appreciate the meaning of their actions. A good quality of brain-tissue is made inefficient by its tremendous handicap; and only later, if ever, when the hold is too firm to loosen, does the man or woman realize what might have been. The formation of habits should look toward the future that they may become the allies of our mature purposes and aspirations instead of their enemies. In early childhood this is largely the business of parents, but in youth and early maturity it should be the chief concern of the individual.

[1] *Principles of Psychology*, vol. I, p. 127.

Resolutions and moral or ethical principles should be determinedly put into action, at once and on every occasion. Letting ideals ooze out in vapid sentimentality produces only a tiresome, ineffective prater. Some men, for example, are mightily concerned over wrongs done to working girls in all factories and stores except their own. Many get their moral contentment by weeping over sin. They go on an emotional spree periodically, and they enjoy the orgy. Virtue oozes from every pore, and they bask in its sublime feeling; but they do nothing. The habit of emotional vaporization satisfies their longing to do good.

Inability to act may become a habit as truly as can action itself. The writer has an acquaintance who for ten years has had a scholarly book ready for publication, but he cannot let it go. He is oppressed with the fear that it will not be up to date, that there is something which he will find if he waits longer—and hunts. It is doubtful whether the book will appear during his lifetime. Some people, again, are always making resolutions—always promising themselves to begin to work vigorously, *to-morrow*, always waiting for a great and perhaps conspicuous opportunity to do a social service, always preparing to break a bad habit; and then, as the habit of postponement becomes fixed, moments of anguish come, followed by periods of elation, as emotional virtue again soothes the mind. These people are rich in purposes, resolutions, and plans, but they never cross the Rubicon and burn the bridges. They are always vacillating between determination and doubt, between hope and fear. Inefficiency is not infrequently caused by this habit of indecision, and the disastrous effect, in this instance, arises, curiously enough, from the very qualities of habit which in other ways are serviceable. It is this advantage and disadvantage of the same features of habits that make their outcome so important for efficiency. This may easily be shown.

Habit, we have said, first diminishes the attention with which acts are performed and then eliminates it. This is, of course, a great advantage in acts which should be mechanized. Its limitation, however, should not be overlooked. Repetition makes perfect, but it perfects only that which is repeated; and the perfection consists solely in "setting" serviceable movements, after the elimination of those that are useless, or with mental processes in bringing information to mind of which we are in frequent need. It enables the physiological machinery to run without friction. Short cuts are formed in the nervous system. The route from eye or ear to muscle is shortened by eliminating the cerebrum from the circuit. Lower reflex centres are called into play and the brain is relieved of the burden of overseeing these activities. After the simpler movements have become mechanized they may be combined into more complex actions, and in this way highly involved reaction-systems may be organized. Release of the brain from the direction and supervision of certain activities is a tremendous advantage, because it is left free for things that cannot profitably be made habitual.

Illustrations are not wanting, however, to show that some acts should not be made habitual. One of the speakers at the Tuck School Conference on Scientific Management[1] said that he found the proprietor of a large printing-house answering telephone-calls. When asked if a boy at the telephone would not save him time for more important things he agreed, but said that he could not let go of such details. "I am constantly doing things which I have no business to do, but I can't get away from them," was the way in which the proprietor of another large establishment admitted his subjection to inefficient habits. These are only illustrations, but they represent the wasteful methods of two men engaged in business. Probably they are typical. Of course men differ in their bad habits as well as

[1] *Tuck School Conference on Scientific Management*, p. 245.

in their good ones; but this merely means that the illustrations of inefficiency vary with different men.

Examples of the "setting" of unproductive methods of work could be multiplied indefinitely. Teachers, according to Thorndike, rarely progress after the third year of service; and it is a common complaint of business men that those in their employ "stop growing" too soon. "The difficulty with which we are always confronted," said the manager of a large manufacturing plant recently to the writer, "is that our business grows faster than those within it. The men do not keep up with the changes." This is an instance of the human tendency of which we have spoken in an earlier chapter, the tendency to adjust oneself to the lowest level of efficiency that will "carry."

These occupation-habits grow out of the need felt for getting things done quickly. The attention is fixed on the accomplishment of the immediate end rather than on the final outcome. Consequently, the person takes short cuts and is pleased with quick results. Time looms large —that is, the time at the moment. He does not see that minutes are saved at an immense expense of future time; and when a trial balance is struck he finds that, so far as achievements are concerned, he is bankrupt. He did not include the future in his mental vision. The final stage of the process was ignored. He was always busy, yet accomplished nothing. He has not even put himself in the line of significant results. This can be best illustrated by an act of muscular skill. A beginner in typewriting makes the most rapid progress by watching the keys and using the two forefingers. This plan, however, and the habits formed by its adoption, will never enable him to compete for the salary of one who practises the slower touch method and employs all the fingers on the keyboard.

A department store in a large city of the Middle West, to illustrate the inefficiency of certain habits in a different

line of business, had engaged an unusually successful Eastern manager at a high salary. In a year he had so nearly wrecked the business that the management paid him $60,000 to annul the contract. This manager had acquired certain business habits which were successful where he gained his reputation, but he could not alter them to meet new conditions. He did not know why his methods had succeeded. He had not analyzed the situation. He merely grew into certain habits which happened to succeed because they harmonized with the conditions in his locality. It is quite likely that these circumstances had something to do with the formation of the habits. Probably, also, the harmony was, in part, a matter of chance. To a certain extent, at least, he followed the method of the stenographer to whom we have just referred. He adopted the plan that secured the quickest results. At all events, he did not understand the reasons for his success. If he had he would have known that the method might fail under other conditions; and he would have been able to readapt himself. "Managers want to get better results in their own way," says one of the most stimulating writers on business efficiency. "They don't want to learn new ways."[1] This is because "their own way" has become "fixed" in their nervous system, and it suggests the rule of action for making habits our allies in promoting personal efficiency.

This, then, brings us to our third point, that *habits to be of advantage should be thoughtfully selected and organized instead of following unconscious adaptation.* Those lacking constructive, productive power should be eliminated before they gain control. A distinction should be made between acts in which definite habits are beneficial and those acts that may best be left free. Perhaps a given kind of work should not be reduced to habit or, if it should, then the sort of habits to be formed is important. This puts intelli-

[1] E. St. Elmo Lewis, *Getting the Most Out of Business.*

gence into the process. After the selection has been made, those acts which can be done best through habit should be made automatic, and the others kept in a free, fluid condition, so that the best method of the moment may be utilized. Human failure is due largely to the fact that habits get us instead of our getting them. The rule-of-thumb man is in this class of failures. He wants rules so that he may reduce his methods to habits. It saves thinking. "The rule-of-thumb man must have his vision enlarged, else it becomes ingrowing," says Lewis.[1] "As a type he is lacking in imagination, and therefore complains because the talks of the board of commerce and articles in the trade papers are not about his business. He lacks the power to adapt, because he can only imitate. Imitation works in a vicious circle, repeating old errors until they become enwrapped in the winding-sheet of sacred tradition, as grandma's remedies and father's policies."

We have been emphasizing the importance of selecting our habits so as to mechanize only those acts which may be made automatic with greatest advantage to efficiency, and to leave the others free. The curtailment of efficiency through failure to follow this course, and the unconscious adaptation to the lower requirements of life, are admirably described by James.[2] Men, "as a rule," he says, "habitually use only a small part of the powers which they actually possess and which they might use under appropriate conditions. . . . The human individual lives usually far within his limits; he possesses powers of various sorts which he habitually fails to use. He energizes below his *maximum*, and he behaves below his *optimum*. In elementary faculty, in co-ordination, in power of inhibition and control, in every conceivable way, his life is contracted like the field of vision of an hysteric subject—but with less excuse, for the poor hysteric is diseased, while in the rest

[1] E. St. Elmo Lewis, *op. cit.*, p. 35.
[2] *Memories and Studies*, pp. 237–238.

of us it is only an inveterate *habit*—the habit of inferiority to our full self—that is bad."

An illustration of the effect of a higher standard of work —the reverse side of the shield so vividly described by James—is the change produced in the methods of biologists as a result of Agassiz's example—a change almost equivalent to a revolution in habits. One evening Agassiz was a guest of the Boston Microscopical Club, "when a member made the statement that he had studied a certain form four days, and feeling that nothing resulted from this elaborate investigation gave it up as impracticable. After some discussion the guest of the evening, Agassiz, was called upon. He astonished his hearers by saying that he had also studied the object in question, *having had it under his eye at stated periods night and day for six weeks.*"[1] At another time, to one of his students, who afterward became a distinguished entomologist, he gave an echinoderm, with instructions to be prepared on the following day to describe its external characteristics. After the description had been given, Agassiz again sent the young man back to the echinoderm, and, as the story runs, he kept him looking at this object for a week. At the end of that time the youth knew something about how echinoderms look, and he had acquired a habit of observation which he never lost. It was with much the same confidence in selected habits, associated with capacity to change, that James J. Hill sent many boys to agricultural colleges that they might acquire methods of investigation. He saw clearly that if they remained on the farm they would inevitably adopt antiquated "farm habits."

In the business world, as in all occupations involving human beings, to illustrate the need of selected habits and adaptive variability in a field too often overlooked, the manner in which the men are treated largely determines

[1] *Louis Agassiz*, by Charles F. Holder, p. 99. The italics are the present writer's.

the success of manager or foreman. Certain methods have been acquired from the environment, education, or training, and they are followed. They secure results but perhaps not the best. Yet these managers know no other way. The Filene Co-operative Association of Boston is an instance of reversal of traditional business habits. The William Filene's Sons' Company decided to give the men and women behind the counter of their department store a voice in shaping the policies of the company. The association, composed of members of the firm and of all employees, may initiate or amend any rule that affects the efficiency of employees. The decision, passed by the council, may be vetoed by the management, but if after such a veto the association again passes it over the veto, by a two-thirds vote, the decision of the association is final. The plan made a sudden break from habitual business methods, yet it succeeded. A single instance will show how admirably and reasonably the employees have responded. "The question for vote was whether the store should be closed all day Saturday, June 18, the day preceding being Bunker Hill Day, a State holiday. If this were done it would give the employees a three-day holiday. . . . Agitation had been quite intense during the days preceding the meeting, for the employees naturally were interested in having an additional day's rest with pay; the meeting was to hear both sides of the question and to decide. After those in favor of closing had made their plea, those opposed brought out an argument few had considered, the fact that conditions were not analogous. It was pointed out that a Saturday in the middle of June was much more valuable and costly to lose than one in July, that it was the last Saturday before the bulk of the school graduations and that much more business would in all probability be lost. When the vote was taken the employees voted by an overwhelming majority not to have the extra holiday. . . . The firm considers" [the

association] "worth many times what it has cost them in their time and money. It is no longer an experiment; it is a fact, and it has made the interests of employer and employee harmonize." [1]

These practical results from the methods of the Filene Co-operative Association are additional proof of the expediency of *selected* habits. Observation shows that it is not only inefficient but also unnecessary to settle down into the line of least resistance and adopt habits of ease or tradition. Reservoirs of energy commonly unused reveal themselves in various ways. In physical endurance, for example, it is well known that at a certain point fatigue ensues. Then, if we persevere, we overcome the resistance and get our "second wind." We feel more vigorous than before and push on to a new achievement, perhaps breaking the record. Under such circumstances we have clearly tapped a new supply of energy, usually concealed by the first appearance of *ennui* and fatigue. "Mental activity," James once said, "shows the phenomenon as well as physical, and in exceptional cases we may find, beyond the very extremity of fatigue-distress, amounts of ease and power that we never dreamed ourselves to own, sources of strength habitually not tapped at all, because habitually we never push through the obstruction, never pass those early critical points." [2] Evidence of this is seen in the achievements occasionally observed in men suddenly placed in positions of great responsibility. The demand on their ability is worth their best effort and they rise to the emergency. "I did not know that it was in him," is our acknowledgment of his bursting through the barrier. It was *not* in him until he broke with his old habits of adaptation to an inferior level of accomplishment.

An illustration of the firmness with which habits settle

[1] *Sketch of the Filene Co-operative Association*, by the firm.
[2] *Memories and Studies*, p. 230.

upon us, and of our feeling, when in their grip, that we are working to the limit of endurance, has just been related to the writer. The incident also shows the higher level that one may reach when forced to break through the enveloping crust of custom. The manager of a manufacturing company had the oversight and direction of 9 plants. "I thought that I was working to my limit," he says, "and I never felt quite caught up. Now, as captain in the quartermaster's department, I have the same oversight of 150 plants, and I do the work just as easily as when I had only 9 under my control." The president of one of the large publishing houses in New York City relates a similar experience. "Since so many of our men have entered the service of the nation," he said recently, "most of us are obliged to do double work. We make our decisions quicker, and, so far as I can see, they are just as correct as when we took twice the time." These two instances testify to the relation between energy expended and the resistance to be overcome—the tendency to minimum effort; and they also show that when once the amount of energy has been gauged, habit fixes the output. To excite more energy, additional and urgent demands are necessary.

The first barriers beyond which these men could not go until insistent demands supplied the stimulus—the "early critical points" to which James referred—are usually the result of inertia. Few obstructions are harder to break through than the habit of energizing at a low degree of intensity. Apparent mental fatigue, again, which may set up another barrier, is usually attributable to other causes than excessive work. "A physician of wide experience says that every day men come to him broken down in health, invariably telling him that they have overworked; and yet upon questioning them he finds that none of them work as hard as he. Their breakdown was due to the terrible load of unphysiological habits which they had

been carrying—a load so great that scarcely any work could be carried in addition."[1]

Sometimes a severe shock is needed to force men to break through these "early critical points." The manager of a large business sent a young man out to survey and report on a certain territory. It looked like easy work, but when the investigator returned the manager asked so many questions about the people, their occupations, wealth, sports, habits, and other things, that the young man hardly knew whether he had been over the ground. Then, after he was told that his position depended upon more intelligent observation, as he has since informed the writer, he became aware of the habits of ease into which he had unconsciously fallen.

Sir Baden Powell has told of a similar method which he used to awaken plodding recruits in India. He sent them out to forage for themselves for a week or a fortnight. During that time they generally had adventures and troubles enough to bring out whatever they had in them. If nothing came out they were hopelessly stupid. Usually, however, the experiences were sufficiently startling to break up their habits of lethargic ease, and by the time of their return they were able to move under their own steam.

Shocks, in the form of sudden responsibilities to which one feels unequal, disturb the smooth running of the mental processes that have produced a complacency which blinded their possessor to his inadequacy in thought and action. Among the contented who are satisfied with doing their day's work just well enough to escape criticism and discharge, there is no analysis of situations, no appreciation of comparative values, always a tendency toward adjustment to existing conditions, always a tendency to economy in making this adjustment, always a tendency to repetition; and with each repetition resistance is decreased.

Viewed from another angle, habit has acquired immense

[1] *How to Live*, by Irving Fisher and Eugene L. Fisk, p. 125.

significance in the last few years because of the greater acceleration with which changes come and go. To-day a man's success in the business and professional world depends upon rapid adaptation to varying conditions. Fifty years ago business methods were settled. A young man learned a trade, entered his father's store, spent a year "reading" law, or studied medicine with a physician, and was quite sure of a satisfactory competence. Business methods were static, and scientific knowledge did not go forward with leaps and bounds. To-day everything is altered. Change, rapid change, is the conspicuous fact in all occupations; and this reveals new meaning in the utility of habit.

"The fundamental limitation of the majority of men, from the standpoint of availability for promotion," said the manager of a large manufacturing company recently, "consists in lack of capacity to adjust themselves to new requirements. . . . I find very few individuals making any effort to think out better ways of doing things. . . . We need, at the present time, four or five subordinate chiefs in various parts of the factory, and I can fill none of them satisfactorily from material in hand." [1] Yet this "material" consists of over a thousand men. Evidently, habits of doing things, of reacting to situations, reaches far into success and failure.

In both physical and mental activity change reduces to an alteration of habits; and habit, we have found, is concerned with nervous impulses and with the activity of nerve-centres. The function of the nervous system is to co-ordinate and unify movements so as to adapt them to the needs of the individual. In the lower animals this co-ordination has been, to a large extent, "set" in instinctive actions. In man the same tendency exists for actions to become "fixed." We then call them reflex. There is always a selection of movements, but this selection is rarely

[1] See *Learning by Doing*, by the author, pp. 212–222.

conscious. In the more delicate movements it is never conscious. The question then arises, How is the selection made? The determining force is always environmental necessity. Among the lower animals it is the requirements of survival—a relentlessly compelling force—and in man it is also the demands of the situation. Success in the business or profession in which one is engaged is the remote incentive. This, of course, creates immediate motives in the various details of the work. Obviously, unpleasant consequences of certain actions will cause the selection of others. But, as was said before, there is rarely a definite standard of success. Consequently, approximately successful actions and methods are selected, and soon they become fixed habits. A careless paper-hanger makes poor workmen of his apprentices, because, if the employer is satisfied, the consequences of indifferent workmanship are not obviously unfavorable. *Habits cease to change and to become more efficient when no practical motive compels improvement;* and with human beings improvement leading to more successful adaptation to conditions and situations has largely supplanted the requirements of mere survival as a driving force.

This relation between habit and practical motives for improvement should be remembered, because so-called "bad habits" usually have a restricted meaning. The implication is that those which do not injure our health or morals are good. Much has been written, for example, in appreciation of the social necessity of habits of thought. Habit, we are told, "is the enormous fly-wheel of society, its most precious conservative agent. . . . It alone prevents the hardest and most repulsive walks of life from being deserted by those brought up to tread therein. It keeps the fisherman and the deck-hand at sea through the winter; it holds the miner in his darkness, and nails the countryman to his log cabin and his lonely farm through all the months of snow. . . . It keeps different social strata from mixing. Already at the age of twenty-

five you see professional mannerisms settling down on the young commercial traveller, on the young doctor, on the young minister, on the young counsellor at law. You see the little lines of cleavage running through the character, the tricks of thought, the prejudices, the ways of the 'shop,' in a word, from which the man can by and by no more escape than his coat sleeve can suddenly fall into a new set of folds. On the whole, it is best he should not escape. It is well for the world that in most of us, by the age of thirty, the character has set like plaster, and will never soften again." [1] The truth in this is that it would play havoc in the world to have no consistency, no stability, no conservatism, to have every one deserting his post and running off on a tangent. Of this there can be no question. The writer ventures to suggest, however, that habit—the tendency to repeat—is so firmly fixed in man's nature that it needs no support of argument.

When Benjamin Franklin, for instance, conceived "the bold and arduous project of arriving at moral perfection," he found that while he was guarding against one fault he was often surprised by another. "Habit took advantage of attention; inclination was sometimes too strong for reason." [2] Al Jennings cites a striking case of habit in a clerk in the Ohio penitentiary. "As he began to instruct me in my duties he talked in a monotone from one corner of his mouth. I took it for a little congenital peculiarity. Really it was a habit he had formed while in the shops. Conversation was forbidden to all but first-class convicts. When they want to talk they look past the hearer to a distant object and speak from the corner of the mouth nearest" [the listener]. "You could watch the other side of their faces all day and never see a movement. He had learned the habit so young that he couldn't break it even in the transfer office, where he had no rule of silence." [3]

[1] James, *Psychology, Briefer Course*, pp. 143 *f.*
[2] *Autobiography*, p. 142.
[3] *Beating Back*, pp. 173 *f.*

Habits, then, returning to their utility for progress, do not contain the element of growth. So far as they are handed down through generations they preserve what the race has found serviceable. It is racial preparedness. Primitive man, having mastered a series of complex actions in one situation, was ready for a similar emergency. The value of this sort of preparation becomes a disadvantage only when life becomes so complex and changeable that the old ways of meeting emergencies are no longer adequate. When man's ancestors first descended from trees, for example, arboreal habits no longer sufficed. It was necessary for them either to change their manner of reacting to dangers or to go back to the trees; and those who went back to the trees, whether figuratively or literally ceased to progress. A recent book, entitled *Arboreal Man*,[1] has the significant title for one of its chapters, "The Failures of Arboreal Life"; and this would be a good motto for business and professional men to hang above their desks. "Different environments," this author says in another connection, "offer varying possibilities of education, but the full educational possibilities are not necessarily grasped . . . by the animal which becomes completely specialized. This is a fact made clear by a whole sequence of geological types which have seized upon their environmental opportunities and have become specialized in an extraordinary degree to fit their environment, only to arrive at specific senility and be supplanted by less specialized and more plastic types. A complete, early, and all-absorbing specialization is almost synonymous with specific senility. An animal which specializes to the limit in response to its environment becomes a slave to its environment and loses its greatest evolutionary asset of plasticity. This, in the end, spells the end of progress." [2]

[1] By F. Wood Jones, London, 1916.

[2] See, also, *The Origin and Evolution of Life*, by Henry Fairfield Osborn, 1917, pp. 159, 257 *f*.

These specialized adaptations of which the author whom we are quoting speaks are habits of the species that have become fixed as instincts. The natural history of animals offers many examples of highly specialized failures, so far as progress is concerned; and the same principle applies to man. A highly specialized individual will act more efficiently within the narrow limits of his special training, but he will inevitably fail in meeting the larger, varying problems of life. He lacks the extended view which includes the broader meanings and implications within its range of vision; and he is wanting in flexibility and versatility beyond the boundaries of his habits of thought and action.

Failure because of adamantine habits produced by this same sort of narrow specialization is also indicated in prehistoric man. The Neanderthals were driven from their places of abode and finally entirely destroyed by a race superior in culture, in industry, and invention. "The Neanderthals, no doubt, fought with wooden weapons and with the stone-headed dart and spear, but there is no evidence that they possessed the bow and arrow. There is, on the contrary, some possibility that the newly arriving Cro-Magnon race may have been familiar with the bow and arrow, for a barbed arrow or spear head appears in drawings of a later stage of Cro-Magnon history, the so-called Magdalenian. It is thus possible, though very far from being demonstrated, that when the Cro-Magnons entered western Europe, at the dawn of the Upper Palæolithic, they were armed with weapons which, with their superior intelligence and physique, would have given them a very great advantage in contests with the Neanderthals." [1] At any rate, the new arrivals, with their greater inventiveness and mental flexibility—they were probably the first of the *Homo sapiens*—produced a tremendous social and industrial change. The Neanderthals, however, during the period of their aggressive adaptation, displayed amazing

[1] *Men of the Old Stone Age*, by Henry Fairfield Osborn, p. 258.

prowess. "There was a very decided disparity between the strength and resistance of their weapons, and the strength and resistance of the animals which they pursued. . . . The chase even of the horses, wild cattle, and reindeer was apparently without the aid of the bow and arrow, and prior to the invention of the barbed arrow or lance head." But by the time of the arrival of the Cro-Magnons they had reached the limit of their inventiveness and progress, and were on the decline. The new race, with its superior flexibility, was able to overcome both the severe conditions of the fourth glaciation and the Neanderthals whom they found as enemies. Finally, however, the Cro-Magnons, having run their course, succumbed, in turn, before more flexible and hence more adaptive races. Probably their failure in the contest of life, without any apparent environmental causes, like the similar decline of certain civilized races, after a period of great industrial, intellectual, and martial progress, was due to the inertness that is always associated with mental stasis. It is an illustration of minimum adaptation. The habits which meet the lowest requirements of survival persist, and when an emergency arises requiring rapid readaptation such static races are unequal to the demands.

Habit, we have said, eliminates consciousness. This has been shown to be an advantage in certain matters. It also dispenses with intelligence. And this is bad, unless the habits are selected with discrimination. If a business man were to ask his employees what habits they had *consciously* formed during the past week he would create a panic among the men. And if he would put the same question to himself he would be unable to find an answer. Efficiency in matters of habit demands an analysis of a given piece of work, as, for instance, of a situation that is to be met, to determine what part of it may best be mechanized and what requires intelligence.

The organic tendency to make adjustments to condi-

tions with the minimum output of effort, of which we have spoken, and the propensity of nervous impulses to continue, subsequently, to follow the path which they first took, with the consequent reduction of efficiency to the lowest level that will "pass," has been found to be as true of mental activity as of the physical; and in thought, with its resulting behavior, release of the brain from supervision by "setting" the mental processes, works disastrously. "Hardly any of us," said William James,[1] "can make new heads" [for ideas] "easily when fresh experiences come. Most of us grow more and more enslaved to the stock conceptions with which we have become familiar, and less and less capable of assimilating impressions in any but the old ways. Old-fogyism, in short, is the inevitable terminus to which life sweeps us on."

This is not a pleasant picture, but the important question is, Is it true? Unfortunately, Professor James has not overstated the facts. But is there no way out, no way of escaping from the slavery of habit in thinking? Not altogether. Habit is an organic fact. Its justification is the need for conserving successful reactions. Having once learned to react successfully in a given situation, primitive man could best preserve himself and the race by repetition. This was because of his low intelligence. Marked variation was a dangerous innovation. With him reactions were at first chiefly physical, but as he developed and life became more complex the mental became more prominent. But, after all, the basis of habit is the same, whether it be in acts of skill or in the most intricate processes of the mind. The nervous system underlies both, and, fundamentally, habit always goes back to the tendency of nervous impulses to repeat themselves.

One of the chief problems in personal efficiency, it should be emphasized again, is to decide what acts may be most advantageously intrusted to habit. These actions—those

[1] *Psychology, Briefer Course*, p. 328.

of the mechanical type—should then be made automatic. No exception should be permitted. With other matters—those requiring intelligence—the difficulty is not in forming habits, for this tendency is always dominant, but in keeping free from them, not in accepting the ideas, beliefs, and customs of those with whom we live and work, but in breaking away from them.

As long as we consider present beliefs and the attitude of people toward present conditions or novel ideas, the advantage of the argument concerning habit is with the conservatives; for it is difficult to demonstrate a better condition, or to prove the value of something that has not yet happened. When we look back over history, however, the view clears.

We commonly think that we advance in the ordinary course of events. "Our habitual instructors, our ordinary conversation, our inevitable and ineradicable prejudices," said Bagehot, "tend to make us think that 'Progress' is the normal fact in human society, the fact which we should expect to see, the fact which we should be surprised if we did not see. But history refutes this. . . . What is most evident is not the difficulty of getting a fixed law, but of getting out of a fixed law; not of cementing a cake of custom, but of breaking the cake of custom; not of making the first preservative habit, but of breaking through it and reaching something better." [1]

What usually happens is that some one breaks away from conventional, habitual thoughts, is condemned for his erratic ideas, and dies perhaps an outcast from "sane" society. Another age erects a monument to his memory, and people gather there in grateful commemoration of the ideas for which their fathers cast him out; and men continue in the delusion that they are progressive. Men who made the sciences upon which our comfort, our health, our lives depend, have been crucified upon the cross of

[1] *Physics and Politics*, pp. 41, 52.

tradition. In what did their crime consist? In offering something new.

A volume could be filled with examples of the abuse of men because they did a social service. Harvey enjoyed a large practice before he published his book *Concerning the Motion and Uses of the Heart and Arteries*, because he was a surgeon of wide repute. But after the appearance of his book he "fell mightily in his practice; 'twas believed by the vulgar that he was crack-brained and all the physicians were against him." Harvey himself, speaking of the reception of his discovery, says: "These views, as usual, pleased some more, some less; some chid and calumniated me, and laid it to me as a crime that I had dared to depart from the precepts and opinions of all anatomists. I tremble lest I have mankind at large for my enemies, so much doth wont and custom become a second nature." [1]

Another illustration of habits of thought is furnished by an instance in the life of Benjamin Franklin, who sent an account of some of his experiments in electricity to Mr. Collinson in England, to have them read in the Royal Society; but the members did not think them of sufficient importance to be printed in the *Transactions*. Among Franklin's other experimental contributions was a paper on "The Sameness of Lightning with Electricity," which he sent to an acquaintance, Doctor Mitchel, who was a member of the Royal Society. Doctor Mitchel wrote in reply that it had been read before the Society, but had produced only laughter. Some of these papers were later printed in a pamphlet by Cave. "A copy of them happening to fall into the hands of the Count de Buffon, a philosopher deservedly of great reputation in France, and indeed all over Europe, he prevailed with M. Dalibard to translate them into French, and they were printed in Paris. The publication offended the Abbé Mollet, preceptor in natural philosophy to the royal family, and an able experi-

[1] F. D. Harris, *Popular Science Monthly*, vol. 82, p. 459.

menter, who had formed and published a theory of electricity which then had the general vogue. He could not at first believe that such a work came from America, and said it must have been fabricated by his enemies at Paris, to decry his system. Afterward, having been assured that there really existed such a person as Franklin at Philadelphia, which he had doubted, he wrote and published a volume of 'Letters' chiefly addressed to me, defending his theory, and denying the verity of my experiments and the positions deduced from them." [1]

Again, Doctor Oliver Wendell Holmes' paper on the *Contagiousness of Puerperal Fever*, published before the idea of infection had gained sufficient standing to be respectable, was bitterly attacked by two of the leading obstetricians of the East. Doctor H. L. Hodge, professor in the University of Pennsylvania, said in an address to his medical students: "The result of the whole discussion will, I trust, serve not only to exalt your views of the value and dignity of our profession, but to divest your minds of the overpowering dread . . . that you can ever convey, in any possible manner, a horrible virus, so destructive in its effects and so mysterious in its operations, as that attributed to puerperal fever."

Doctor Charles D. Meigs, of the Jefferson Medical College, Philadelphia, in his book on the nature and treatment of puerperal fever, said, speaking of infection: "I utterly reject and deny it; and of course I shall not be distressed because two very young gentlemen" [of whom Oliver Wendell Holmes was one] "say: 'We think the contagiousness . . . of childbed fever . . . is a fact established on the most irrefragable evidence. . . .' And shall we now go back again to the capabilities of a Celsus, or an Avicenna, or an Avenzoar? Or shall we rather disregard the jejune-dreamings of sophomore writers" [Holmes and others] "who thunder forth denunciations, and would mark,

[1] *Autobiography*, pp. 269 *f.*

if they might, with a black and ineffaceable spot, the hard-won reputation of every physician. . . ." [1]

Galvani was ridiculed as the "frogs' dancing master," Daguerre was put into an asylum for saying that he could transfer the likeness of human beings to a "tin plate." Ohm, also, was thought insane, and Florence pleaded for the dust of Dante, whom only a century before she had ordered to be buried alive. Cuvier angrily threw fossil bones out of his window, and buried their meaning in derision for thirty years. Lavoisier *proved* that meteorites could not fall from the skies, the Bavarian Royal College of Physicians asserted that railroads would ruin the health of the people because the rapid motion would give the travellers brain disease, and Professor Lovering of Harvard *demonstrated* mathematically the impossibility of telegraphing three thousand miles under the ocean. Lebon, the discoverer of illuminating gas, died in ridicule because he believed in "a lamp without a wick." Jouffroy, the inventor of steamboats, passed away in poverty, having spent all of his money in vain attempts to change the habits of thought of the people, and Lardner's essay proving the impossibility of the steamboat was brought over from England in the first boat, following Fulton's invention, to cross the Atlantic; Young, a physician, saved his practice by anonymous publication of his theory of light, color, and luminiferous ether, a century after Hooke had first made the discovery; Plenciz observed as early as 1762 that certain diseases and decomposition were caused by micro-organisms, but it was not until Pasteur's discoveries in 1876 that the bitter controversy was ended. And we are still in the midst of the fight against antitoxin serums and animal experimentation.

[1] Doctor Osler, in an address before the Johns Hopkins Medical Society, October 15, 1894, referred to Doctors Hodge and Meigs as "the two leading professors of obstetrics in this country" at the time of this controversy with Oliver Wendell Holmes.

These illustrations could be extended indefinitely, but they are sufficient to indicate the evidence for the statement above that habits of thought do not need nurturing. Resistance to habits, or at least conscious selection of those which we allow to gain a hold, is the first principle of efficiency and progress, and this is what Rousseau seems to have had in mind when he exclaimed: "The best habit to form is to contract no habits whatever."

Man, however, as we have seen, likes to feel that certain questions are answered, certain problems settled. Frequent rearrangement of opinions and of ideas, to make them consistent with new facts, would keep one thinking; and thinking is a strain. So ideas are classified and tied up in bundles, properly labelled. Then when a social or business proposition is laid before us we know at once which bundle to untie. This is classification and "order." Everything is put away in our mental files, and all that is needed to settle a question is to find under what subject it is classified. This is a convenient and easy method. Its only fault is that it leads nowhere. It ends in a blind alley. An excellent illustration is the comments of writers and preachers on the suicide of General Nogi. Obviously, knowledge of the religion and philosophy of Bushido was necessary for an understanding of his act. The Anglo-Saxon classification of ideas was inadequate for its interpretation. The explanation of fossils as models of animals upon which God practised, and with which he was dissatisfied, is another illustration. It was an attempt to make the new conform to the conventional classification of causes, of things, and events.

Organization of ideas is necessary, of course. This is the way in which the laws of science have been gained. But no classification or generalization should be regarded as final. Ideas should be kept in a fluid state, so that they may easily make new combinations. Settled opinions, "filed away," may be as unsuited to the new condi-

tions as were the ideas of Rip Van Winkle when he awoke. "You will never find your way out," angrily cried the chemist Biot to Pasteur, when he refused to give up his researches on spontaneous generation. That was because Biot's opinions were rigidly classified. They could not form new combinations. When Ericsson asked for an appropriation to build the *Monitor*, Fox,[1] assistant secretary of the navy, and the naval board, condemned the idea. They said that the heavy armor would sink the vessel. Their opinions were organized and filed away. They would not even test them with arithmetic, as Lincoln wished them to do. The department store, the cost-keeping systems, loose-leaf books, gathering statistics, charting the demand for commodities, adding-machines, card methods, all these things and many more have been condemned by the classified opinions of business men.

"You see all organization, with its implication of finality, is death," H. G. Wells makes Mr. Britling say. "What you organize you kill. Organized morals or organized religion or organized thought are dead morals and dead religion and dead thought. Yet some organization you must have. Organization is like killing cattle; if you don't kill some the herd is just waste. But you mustn't kill all or you kill the herd. The unkilled cattle are the herd, the continuation; the unorganized side of life is the real life. The reality of life is adventure, not performance. What isn't adventure isn't life. What can be ruled about can be machined, and there is always a tendency to organize and then to automatize."

When the relations between the individual and his environment are definite and maintained, habit dominates. Even when these relations are indefinite and subject to alterations, habit still tends to rule. This is shown in acts that involve volition.

[1] Mr. Fox later saw the value of Ericsson's invention and became one of his most vigorous supporters.

Experiments involving choice between different responses carried out by Barrett[1] illustrate this. We quote his description of the outcome. "Regularity in the reactions," he says, "was manifested *in every phase of the choice-process*, in the manner of reading the" [different] cards" [to which the persons reacted], "in the manner of reacting, and of realizing the choice. Automatism entered into every detail of the experiment. Even the experimenter came to perform the various functions in a perfectly automatic way, so much so that the salient note of the whole experiment, toward the end of the series, was its mechanical regularity. . . . We see that the natural tendency is toward automatic choosing. The times grow shorter, the number of phenomena" [admitted within the field of choice by the individual] "grows less, only one alternative is considered; there is economy in every sense, and finally the motivation reaches such a point that it never, or practically never, deviates from a certain curve or motivation track."

In Barrett's earlier experiments those who were being tested made many remarks about motives, feelings, and judgments which influenced action, but toward the end they had little to say. "There was nothing to remark. There were no feelings, hesitations, or motives to describe. The mental act had become direct and simple. . . . The will had gradually ceased to expend useless effort. Volitional force was economized. . . . Automatism held sway, and there was nothing to record." That is a pretty good description of stagnation as far as mental activity is concerned; yet it seems to be the final outcome of being possessed by habit. Evidently, if one is to have living thoughts, if, indeed, one is to think at all, it is necessary to set up a determined resistance to the encroachment of habitual modes of thinking and behaving.

Experience gains value to the extent to which inten-

[1] *Motive-Force and Motivation Tracks*, by E. Boyd Barrett, pp. 140, 149.

tional thoughtful variation characterizes the range of activities. For, as Rousseau long ago said: "He who has lived most is not he who has numbered the most years, but he who has been most truly conscious of what life is. A man may have himself buried at the age of a hundred years, who died from the hour of his birth. He would have gained something by going to his grave in youth, if up to that time he had only lived."

Measuring up to our possibilities is a troublesome matter, not because of lack of desire—for the vast majority of people are anxious to do so—but because of the difficulty of realizing on our abilities, of turning them into achievement. Man, like his forebears, was made on the plan of adaptation, and adaptation means fitting into conditions. It does not lead to progress, unless external conditions force such a change. Habit is a preservative. It conserves and fixes those types of behavior which help the individual to fit into his environment. But habit is satisfied with the lowest level of "fitness." It must, therefore, be controlled and directed, else it does not serve us well.

We have found that habit eliminates attention. Only those matters, therefore, which finally require no attention should be intrusted to it. Consequently, selection is necessary. Acts of muscular skill, ethical and social behavior should be reduced to habit; and then no deviation should be tolerated. But even here it must be remembered that there is always a tendency to form habits before a high degree of muscular dexterity or of ethical and social attainment has been reached. This makes the difference between poor workmen and skilful artisans, as well as between mediocre tennis and golf players, and those who can qualify for tournaments; and the same distinction exists in behavior in general.

The elimination of attention from habitual processes reveals the activities from which habit should be barred. It is a distinct advantage to relieve the higher brain cen-

tres of the supervision of skilful movements which have been acquired during the preliminary apprenticeship in work or games; and one should not need to wait to decide on acts of courtesy. It is disastrous, however, to free these higher centres from control of matters that require intelligence. For habit is a treacherous ally. It takes us off our guard and registers all our acts. Its subtlety is seen in our ignorance of the fact that it possesses us. Those who condemned the discoveries of the men to whom we have referred did not know that their minds had become inflexible. They believed that they were thinking and that they were doing a social service. Freedom from habituation is relative; thoughts, opinions, and beliefs are largely fixed by social groups, and we adjust ourselves to them involuntarily and unintelligently. Then they become fixed as mental habits of which we are no more aware than we are conscious of our professional and family mannerisms. We believe that we see the reason for them, so gentle and insinuating is their mastery.

CHAPTER IV

THE PSYCHOLOGY OF LEARNING

LEARNING in its widest sense is profiting from experience. Education is sometimes said to consist of habit formation, but we have seen that habits mean repetition, and that only those acts should be repeated which can best be performed when automatized. Even these acts should not be reduced to habit until they have been perfected and, as has been said, the tendency always exists to mechanize at a low level of attainment. Ability to continue learning—to improve upon what one has already done, to see more meaning in experience—measures intelligence.

The higher animals stand in the evolutional scale the more prominent is the rôle that learning plays in their lives. In man it is the method of development. There are, however, certain general aspects of learning which may be set apart from its narrower applications as manifested in acquiring facility in some act of manual skill, and it may be well, first, to consider some of these larger phases of the subject.

Human activities may be roughly divided into the mental and physical. To be sure, the one never exists without the other, and, consequently, such a classification only indicates somewhat freely the dominating feature. Now, there is a rather wide-spread belief that these two sorts of activities differ essentially in their origin. The physical activities, including as they do the manual arts and trades, are generally admitted to be improved by instruction. Skill in certain mental arts, however, is commonly thought to be an exception to this rule. They are believed to be

above the slow, laborious process of acquisition, and to emerge from innate qualities of the mind.

This attitude prevails not only regarding literary ability, but also in the various branches of business, as in advertising and salesmanship. "Start into the work and if you have aptitude for it your ability will soon show itself," is the advice often given to young men. Recently one of the editors of a large city daily said to the writer that in his opinion young men should be taken directly from the high school into a newspaper office. If within a short time they give promise they should be retained. Otherwise it would be better to dismiss them and try others until the right ones are found.

Certainly, no one will deny special aptitudes. Nevertheless, this contempt for instruction reduces learning to its crudest, least intelligent expression. It is the animal method of blundering along, trying one device after another until a mode of action has been hit upon that by chance secures the desired result. Little intelligence can be used in the selection of methods of procedure because the learner is not sufficiently acquainted with the work to judge their worth. He is like a traveller wandering around in the underbrush of a forest. He cannot see whither the many trails lead. Consequently, if he gets into the right path it is largely accidental. And this is exactly what happens to an uninstructed learner. He is confused by the underbrush of details. He cannot get a bird's-eye view. His methods of meeting difficulties are therefore fallen upon accidentally. If they accomplish the desired end they are adopted. In this way uneconomical and comparatively unproductive methods become habits.

Charles Francis Adams is a splendid illustration of this confusion. His *Autobiography*[1] is a painful history of opportunities unutilized because of incompetent guidance—a round peg always trying to get into a square hole, as he

[1] Boston and New York, 1916.

himself phrases it. That is just what the animal method of meeting problems and situations does. The only difference is that animals in the wilds must remedy their serious mistakes or pay the penalty with their lives. Boys are protected, and thus their errors are continued. I do not remember having read so bitter an arraignment of unintelligent direction as Mr. Adams' enumeration of the mistakes of his childhood and youth. Probably his chief misfortune was that his family had money and social standing. He was kept in pedagogical preserving fluids. "I should now respect myself a great deal more," he writes, "if I had then rebelled and run away from home, to sea, or to the devil. Indeed, if I had had in me any element of real badness, or even recklessness of temperament, it would have been fatally developed. But I wasn't bad or a daredevil; and I was born with a decided sense of obligation to myself and to others." Most of us would not rank Mr. Adams as low as he estimates himself. He certainly did not achieve that of which he was capable, and for this the unintelligent guidance to which he was subjected was responsible; but he was a distinguished failure. His mistakes seem to have been caused by unwise advice and direction, which, of course, produce the same errors as lack of instruction.

It is in the "self-made" men, however, that the animal method of making progress is most clearly discernible. With them, except so far as advice puts them in the instructed class, experience is gained by uncontrolled, and largely uncriticised, trial and error; and it is this absence of intelligent criticism that distinguishes the lower use of the trial-and-error method from the higher. Deficient knowledge because of a lack of preliminary study and instruction leaves a weakened substructure for judgment. Under these conditions interpretation of situations is inadequate, and experience is reduced to stereotyped opinion.

A brief reference to the learning process of lower animals

will show how much it has in common with the uninstructed learning of man. If an animal is confined in an enclosure with winding paths, all except one of which end in blind alleys, he will run about until by accident he finds the path that leads to the exit where food rewards success. Now, if again placed in the enclosure, the animal will not at once follow the direct path to the exit and food, but he will repeat many of his former errors. By degrees, however, he will finally learn to take the direct course to the food. We say that the animal has learned to get out of the enclosure. What actually has happened is that a connection—an association—has been formed between a situation consisting of confinement in an enclosure of definite appearance and following a certain path to food. The situation favored or permitted various responses, the possibility of which was provided for in the instinctive equipment of the animal. The responses were made at first, without selection, and one of them happened to meet the requirements for reaching the exit and securing the food. Gradually the useless actions were eliminated, and the correct associations attained sufficient strength to produce the series of effective responses without error or delay.

This same association can be established between actions that have no necessary relation to one another. It is well known, for example, that dogs can readily be taught to sit, or stand on their hind legs, to obtain food. In the same way they may be trained to go to the corner of the enclosure farthest from the exit and turn around an exact number of times to secure food. The elements of these associations may also be increased so as to form a long series. Several connected enclosures may be made, and the animal may learn to pass from one to the other in quite different ways, pulling a string to open a trap-door in the first case, pushing up a lever in the second, climbing a ladder and going through a hole to reach the third enclo-

sure, and finally returning to the point of departure by a different route to find food awaiting him. In all of these cases the response is made directly to a given situation, without the intervention of ideas. A certain situation is associated with a given response.[1]

The absence of ideas means absence of thinking. No inferences are drawn. Change the setting to any great extent and the responses are likely to be disturbed, though the essential element in the situation—the one to which a definite response must be made to secure the desired result—may be quite as conspicuous as before. In other words, the result is not connected with a certain action upon a given object. There is no recognition of cause and effect. It is interesting to observe, however, that some of the more highly developed among the lower animals seem to select and pay especial attention to those parts that are connected with the essential element, and changes in its location do not always disturb them. But this is probably due to persistent and strengthened association rather than to any discernment of the relation between cause and effect.

Now, the prevalent opinion that man's method of learning is commonly different from that of the lower animals is unjustified. Animals learn by association. When one event follows another they assume that the succession will always occur. In some instances the response to such an occurrence becomes settled as an instinct. Chickens going to their roosts in the middle of the day during an eclipse of the sun is an illustration. For all the practical purposes of life such responses assume that the first event is the cause of the second. Now, it is not difficult to show that man employs this same associative learning more

[1] Those who wish to make a more detailed study of learning among the lower animals may consult *Animal Behavior*, by C. Lloyd Morgan; *Behavior*, by John B. Watson, and numerous reports of investigations in the journals for general and comparative psychology, especially the *Journal of Animal Behavior*.

commonly than is supposed. Recent investigation[1] of the way in which he solves a maze problem has shown that "the rational processes reported were unsystematic and seemingly futile. Adequate interpretations were suggested to the learner as the result of prolonged exploration, rather than reasoned out. Cues which logically should be utilized for correct inferences were disregarded, and ideas were acted upon in an uncritical manner until they were proven by trial to be incorrect." If the word "rational" were omitted from this account the description would be such as might be written of animal learning.

In those cases in which this process of associative learning seems to carry the learner forward in his thinking, he assumes that he is reasoning. The difference between this pseudo-reasoning and the real thing is that reasoning, whatever else it means, requires that the essential element in a situation be selected from the mass of unessential factors, and that its necessary connection with the result be discerned. "Associative reasoning" assumes that an action or other event which precedes the second has some necessary connection with it, as that of cause to effect.

One need not go back to the belief in a necessary connection between phases of the moon and sowing crops for an illustrative example of this sort of reasoning among human beings. The summer of 1915 was cold and rainy throughout the central and eastern parts of the United States and, as will be recalled, the belief was quite prevalent that the unusual "weather" was caused by the firing of cannon on the battle-front of Europe. When this idea was first promulgated by the "science editor" of certain newspapers the unintelligent accepted it and those better informed smiled. Later, however, when the low temperature and rain continued, even intelligent people began to say: "After all, there may be something in it." This belief is, of course, the persistence in another form of the old superstition

[1] Fleming A. C. Perrin, *Psychological Monographs*, no. 70.

that rain can be caused by producing an artificial atmospheric disturbance. Naturally, "reason" did not give the same conclusion the following summer (1916) when an unusually high temperature was recorded in those localities which were cold the year before, and when, though the firing was continuous, the rainfall was considerably less than usual. Of course the error is forgotten, and right here we find another characteristic of human learning common to that of the lower animals. The latter quickly forget an event unless it has been worked into their nervous system by repeated experiences or has become instinctive through natural selection. Were it not so, new devices would have to be frequently invented to trap them. In man, also, the same methods of "trapping" continue effective.

The "Spanish swindle," which is a good illustration of repetition of the same deception, is so old as to have its origin almost lost in the past. Yet it still serves its purpose. In its simplest form it consists of information that a large sum of money awaits one in Spain. But a "small" amount is needed to secure the legacy. Again, the tricks of "wire-tapping" to obtain advance information about the winning horse, and other swindling devices, continue to succeed, even with those who know of them. Were it not for forgetfulness, swindlers would need to be geniuses at invention. But, as with the lower animals, the old tricks are usually as good as new ones. In man speedy forgetfulness is both a misfortune and a boon. The sorrows of yesterday are submerged in the joys of to-day; and an important element in the psychology of the stock-market is that the pessimism of last week is forgotten in the present elation, though to-day's rise may be made to order. This human tendency to forget is of supreme importance in the psychology of learning, so far at least as what one learns through experience or otherwise is to be used in reasoning.

In speaking of animal learning, it was observed that the particular action which produced the desired result was one of many. The others either opposed success or were indifferent to it. The successful movement, or series of movements, was not planned. It was not even consciously selected. Given a continuous succession of more or less random movements, all directed toward a definite end, and some of them will be more effective than the others. Indeed, if the effort is persistent, the desired result will finally be attained. A fly is biting the cheek of a very young baby. Many random movements are made in the struggle to relieve the discomfort. At last one of these movements succeeds and the fly is brushed away. It is the same with the lower animals, and so it is with man in learning any act of skill.

Now, a matter of the utmost importance in the psychology of learning has been noted in connection with the random movements to which reference has just been made. The successful movement is produced without any further conscious guidance or selection than is supplied by the general effort to attain a desired result. Learners, in acts of skill, suddenly find themselves employing definite methods to meet certain difficulties. Quite commonly they do not know that they are using these methods until they notice that the difficulties are disappearing. There seems to be a competition of methods. Just how a selection of the efficient method occurs without conscious interference is not easy to say.[1] "What happens in such cases," according to Thorndike, "is that the response, by being connected with many situations alike in the presence of the element in question and different in other respects, is bound firmly to that element and loosely to each of its

[1] Those interested in the theoretical discussion of this question may consult, among other writers, the following: Edgar James Swift, *American Journal of Psychology*, vol. 14, p. 201; Edward L. Thorndike, *Animal Intelligence: Experimental Studies*, p. 264, and John B. Watson, *Behavior, Study in Comparative Psychology*, chap. VII.

concomitants. Conversely, any element is bound firmly to any one response that is made to all situations containing it, and very, very loosely to each of those responses that are made to only a few of the situations containing it." [1]

The present writer, in the first report[2] of his investigation of the learning process, called attention to the fact that unconscious adoption of methods of procedure in acts of skill is fundamental in human learning. Later investigation of the writer[3] sustained this observation, and recently it has been verified by various investigators.[4] Because of the importance of this principle, which may be called the *law of unconscious adoption of method*, it may be well to quote briefly from some of the later investigators. L. E. Ordahl, in her study of *Consciousness in Relation to Learning*, found that methods changed and improvements appeared without conscious control. Unconscious modifications were continually cropping out. Then, as consciousness was gradually freed from details, these modifications were noticed, practised, and improved upon. Ruger observed that "a large percentage of the fortunate variations came altogether unpremeditatedly." And Book, in further verification of the present writer's original report, says that "a second significant fact about learning is that all adaptations and short cuts in method were unconsciously made. . . . The learners suddenly noticed that they were doing certain parts of the work in a new and better way, then purposely adopted it in the future."

Illustrations of this unconscious adaptation to work and games—the method of improvement in uninstructed learn-

[1] *Educational Psychology*, vol. 2, p. 44.

[2] *American Journal of Psychology*, vol. 14, pp. 218 *ff.*

[3] *Psychological Bulletin*, vol. 1, p. 295.

[4] W. F. Book, *Bulletin* no. 53, *University of Montana*, p. 95; William H. Batson, *Psychological Monographs*, no. 91; Louise Ellison Ordahl, *American Journal of Psychology*, vol. 22, p. 158; Henry A. Ruger, *Archives of Psychology*, no. 15.

ing—will readily occur to the reader. The beginner in golf finds himself obliged to make various new muscular adaptations of considerable delicacy. That a nice adjustment of muscles is necessary is shown by the exceedingly slow progress of the learner. There is probably more discouragement in golf because of the intermittent and frequently indiscernible progress than in any other game. This means that the muscular tensions, contractions, force, etc., must be accurately gauged. Driving the ball in just the right direction and in a straight line, especially when the course is lined on either side with hazards or with natural obstacles, involves a nice adjustment and co-ordination of eye, hand, and arm muscles. These adjustments cannot even be named, much less consciously controlled. The most that one can do is to control the larger muscles—stand in the correct position, keep the head still, the eye on the ball, give the arms the right swing—and try to get the general effect.

Every beginner knows how little all this accomplishes until the finer muscles have begun to make their unconscious adjustments; and no learner can designate the time when this occurs except as he, often to his surprise, suddenly finds that his good plays are more dependable. In other words, the learner's attention—except for thought of the larger muscles—is upon the accomplishment of the purpose, upon the result. All of the fine adjustments and co-ordinations, and there are many, are made unconsciously in the general effort to achieve success. After these adaptations have been made a sufficient number of times to acquire some degree of consistency, the learner observes them and then they are consciously adopted and perhaps improved upon. This is, of course, possible only in the case of such movements and tensions as can be singled out for control when once the adjustment has been made involuntarily.

We have said that the *law of unconscious adoption of*

method characterizes uninstructed learning. In a large degree it is also active when the learner is under instruction. In golf, for example, the most that a teacher can do is to give general directions, and *tell his pupil wherein he fails.* This last is of special importance because one cannot observe oneself. Knowledge of failure, then, centres the attention on definite details, such as the position of the hands in grasping the club, holding the head still, and keeping the eyes on the ball. The adjustment and other adaptations, however, must still be made unconsciously, except so far as one is attentive to the result and to the muscles that can be controlled voluntarily. And this is as it was in uninstructed learning.

This *law of unconscious adoption of method* has been demonstrated only in acts of muscular skill. But the writer is convinced that it has much wider application. In entering upon new work, as in beginning the practice of law or engaging in salesmanship in a wholesale or retail house, one meets certain difficulties which must be overcome. It is not necessary that these troubles be so conspicuous as to cause the learner to sit down and think them over and consciously decide upon a plan of action which he thereupon rigorously carries out. Indeed, in the writer's opinion, this is the exceptional mode of procedure. Serious and persistent reflection, involving as it does logical thought, is, as we have seen, too difficult to be popular. Besides, successful thinking needs material upon which to work, and in situations involving human beings this raw material consists of knowledge of man's response in various social relations. Few men have this information, and its lack discourages thinking. A naturally hard task is thus rendered still more difficult. As a result men respond to any given situation in what may be called their natural way. That is, their individual peculiarities largely determine their manner of response. They meet the difficulties unthoughtfully as they arise, much as they would in an

act of muscular skill. A man suddenly finds that he is performing the details of his work, and acting in the presence of certain situations, in very definite ways. The success of these responses, which the beginner has unconsciously adopted, will, of course, as in the case of muscular skill, depend upon his natural aptitude for the work in which he is engaged.

Even before these forms of response to situations have been noted by the person who makes them, they have become habits of behavior. Unhappily, the person most concerned is usually the last to discover them. An investigator[1] of teaching has demonstrated the advantage of an accurate shorthand report of everything said in the classroom by teacher and pupils. It is a remarkably valuable critic of human behavior, and might well be adopted in business. If a salesman, for example, could read a verbatim report of his conversation with his customers, he would obtain a picture of himself such as no critic could give. And it would be the most profitable moving-picture performance that he could attend. To be sure, shorthand and phonographic repetition of one's responses to situations would be much like gazing at one's own skeleton, but the view would enable one to clothe it more presentably on another occasion.

The habits that grow out of the responses to situations will depend, among other things, upon the standard of efficiency set by the learner. If he is contented merely with accomplishing the task, any way that produces an approximate result will satisfy. Should he, on the other hand, take account of some of the other factors that make for efficiency, as quality combined with rapidity, his methods or responses will vary until the standard toward which he is striving is attained. This flexibility in habits of performance presupposes an understanding of the signifi-

[1] *The Question as a Measure of Efficiency in Instruction*, by Romiett Stevens.

cance of the situation. For without this comprehension the standard of attainment will not be commensurate with its possibilities. High standards of achievement therefore demand an inquiring attitude—a state of mind which is continually looking for problems in the daily work. The inefficient teacher, business man, or salesman, is the one who is unable to distinguish the various problems in the general mass of details. For such a teacher the one question is that of order, of discipline, instead of the development of personalities.

To a salesman of this type different customers present no interesting situations calling for varying responses. We see here, again, the need of preparation on the part of the learner to enable him to interpret situations—to see their meaning. The most conspicuous characteristic in the sales and advertising managers, before whom the writer has lectured, is their insistent demand for rules of action. Now rules of behavior imply uniformity in situations. They do not admit differences. They presuppose no problems.

If the writer is correct in this brief analysis of human response to situations, it reveals again the vagueness, the uselessness many times, of "experience." For it is a truism that the experience of an individual is colored by his mode of response. And this is settled quite as much by a man's permanent and temporary "make-up" as by the situation with which he is confronted. The permanent characteristics, being chiefly inherited, are largely beyond control, but the temporary condition is, above all else, the attitude taken toward the several problems presented in the situation. This, again, explains why the same outward set of circumstances is experienced differently by various persons. Their response *makes* their experience. They see things differently as truly as do myopic people. And their feelings and interpretations vary because of their different visions.

The significance of experience in learning is not merely

that it is one phase of the process, but also that it determines future experiences by fixing the attitude and method of approach to situations. A man is biassed by the opinions which he has formed as a result of previous experiences. Consequently, he does not approach the new with an open mind. He has acquired a certain mental "set" which perverts his judgment. This is one of the reasons for the importance of instruction. For, after all, teaching consists largely in constructing and in reconstructing experience. In the case of the more mature it is chiefly the latter.

If the instances which have been cited are indicative of human action in general, they emphasize again the important fact in adaptation and behavior, that man adopts the simplest method that will approximate the results which he wishes to gain, instead of examining ways and means with the view of finding the most efficient plan of action; and in thinking his procedure is the same. He accepts superficial evidence, assumes that things are as they appear to be. Therefore, if one event follows another, the first is accepted as the cause of the second. Consequently, when a given method in salesmanship or advertising is attended by success, the method is assumed to be good in all localities and on every occasion. Yet prevailing conditions may occasionally produce results, regardless of the quality of salesmanship or advertising. Since, however, this happy combination of circumstances is not likely to be reproduced, the man who does not understand them is beginning a career of failure. He does not see the meaning of action and response. He misunderstands the human mind. He fails to comprehend the significance of behavior. In thinking and acting, chance thus creates disordered responses, the chance of poor instruction or no instruction at all, and the chance of business tradition and opinions. It is the animal method on which human behavior has been grafted.

Turning now to learning in the narrower sense of gaining proficiency in some definite act of skill, we find that the investigations have disclosed several facts of considerable moment in the psychology of learning. Typewriting is an unusually good illustration because it is typical of much of the work done by the younger men and women in business offices. Fortunately, several investigations have been made of the progress of beginners.

Two different studies were undertaken by Hill and Rejall.[1] These experiments consisted of typewriting, on successive days, with occasional intermissions, first, the same 100-word paragraph, and second, a 300-word page of changing material. The practice was continued for five months. The measure of progress, in the one case, was the length of time required for writing the 100 words, and in the other the 300 words of new matter. The two striking characteristics of the experiments were irregularity in the acquisition of skill and occasional delays in progress. The meaning of the irregularities is quite clear. Progress is rarely continuous. Some of these variations are caused by the physiological condition of the learner. He may not be "fit." A night out, slight digestive disturbance, or fitful sleep are sufficient to blunt the edge of one's feelings, and consequently to lower efficiency. At times, again, the learner feels splendidly, yet for some undiscoverable reason he is not able to get results. Every one has such days. But the physiological condition does not explain all of the irregularities in progress. A beginner in a new sort of work, or a new subject of study, advances for a time and then suddenly, and often unexpectedly, his progress is interrupted. He may work as hard as before, yet for some reason he does not advance.

These periods of temporary arrest of progress are called plateaus in the curve of learning, and the investigation of the acquisition of skill in typewriting to which reference

[1] *Pedagogical Seminary*, vol. 20, p. 516.

has just been made reveals several of them.[1] On the 25th of November, for example, one of the investigators wrote the 100-word selection in four minutes and seventeen seconds; but between that day and the 6th of December, inclusive, there were only three days when he reduced the time required for the task. On all the other days of the ten devoted to the work his record was either the same or worse than on the 25th of November. One of these improved scores was only seven seconds better than the record for the 25th of November. It is quite evident, then, that we have here a period of arrest in progress.

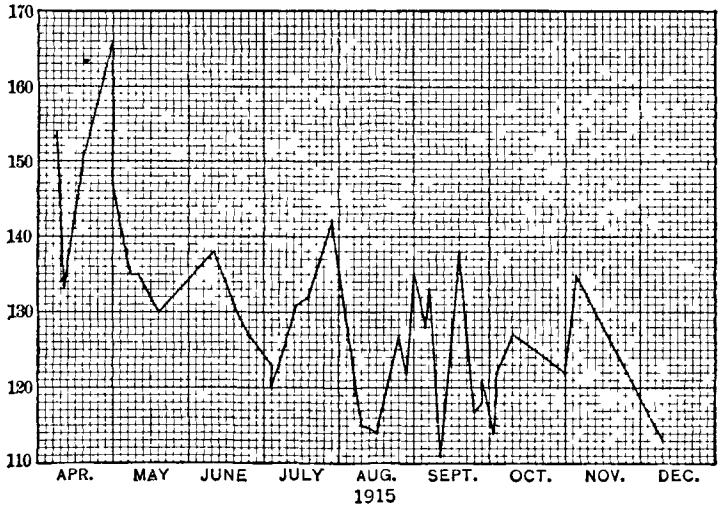
Intermittent improvement in score indicates the tendency of the learner, but he cannot yet be depended upon to maintain the record. In a longer or shorter period of time, however, the better score becomes a permanent acquisition. Barring occasional "off days," the learner now knows that he can make it. This new record becomes the centre, as it were, around which the score for a week or so is likely to oscillate. Sometimes the learner will do better, and again not so well, but he rarely falls back to an earlier lower level of accomplishment. Improvement is, therefore, usually intermittent. After hovering around a certain record for a time—in typewriting several days or a week—the learner goes forward. Then his new achievement becomes the centre of variation until he is prepared to make a further advance. The following experience in golf, written by a friend, illustrates both retardation, which appears in the curve of progress as a plateau, and also temporary improvement, which, though not maintained, shows, nevertheless, the drift of the learning process.

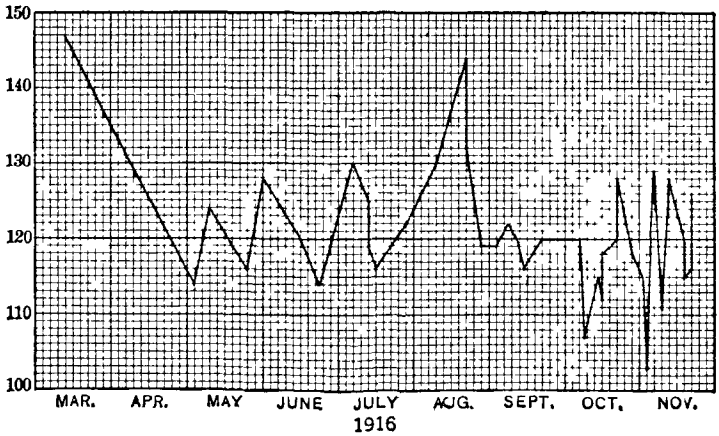
[1] Professor Thorndike, who prepared the experiments for publication, says that the absence of "any clear plateaus or 'resting stages' is noteworthy." The explanation is that his curves were plotted from weekly averages. Whether plateaus would show themselves in such a curve depends, in large part, upon their distribution. In a curve plotted by days from Hill and Rejall's figures several plateaus extending from four to seven days are quite evident.

"I had played golf with unsatisfactory results for a year and a half and had succeeded in getting good control of the various irons, but I had acquired no certainty in driving. In order to overcome this difficulty I had taken lessons and had learned the theory so that it was at my command, but in practice the results were more often disastrous than good. I could not see any positive improvement from month to month in the certainty of my drive. One day I took my usual position for driving. Before making the attempt I thought over the directions for successful driving, and went through the act once, trying to just graze the ground, and following through with my club. Again I took my position. This time the movements were enlivened with the thought that I was going to hit the ball and see how far I could drive it. There was neither pull nor slice, and the ball went almost as straight as one could draw a line in the direction in which I had intended. The distance was about 160 yards. Again I took my place and added 20 yards to the drive. As many as fifteen consecutive drives were made, only one of which was defective, and the distance increased until it reached about 200 yards. For several weeks I drove with equal success, in one case on links on which I had never played before. My longest drive was over 240 yards. After a number of weeks of successful driving I was playing one day, and for no apparent reason I topped the ball. Again and again, both that day and on subsequent days, I endeavored to recover the skill which I had lost in a way I could not explain. Several months have passed, and I have not yet regained the successful drive which I acquired so suddenly and carried on so successfully for several weeks and then as suddenly lost. It seems to be a case of persistent retardation, but what I have done I can do again, some time."

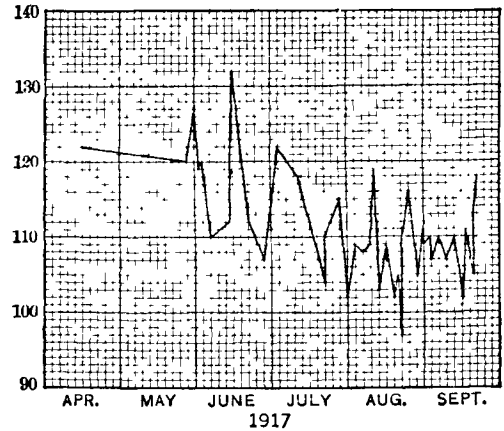
The writer has obtained the golf scores of an enthusiastic player. They are his record for three consecutive

years. The scores are given at the left of the curves. It will be observed that there is general progress from year to year, but the plays are irregular and plateaus are evident.





GOLF SCORES



GOLF SCORES

The discussion of plateaus seems at times to reduce itself to a definition of the term. According to some, only those delays which can be measured by weeks are plateaus. Yet an arrest of visible progress during a number of days demands an explanation quite as much as retardation extending through a month. If the cause cannot be found in the physical condition of the beginner, it must be sought in the complexity of the activity, in the aptness of the learner for the work, or in both. Now, periods of retardation of longer or shorter duration are usually observable in most learning processes. They do not occur when the act of skill is so simple as to be at once mastered, and their location depends in large measure upon the nature of the work in which the learner is engaged. In beginning the study of psychology, for example, a long plateau quite commonly occurs about the end of the third or fourth week. In embryology, on the other hand, it is usually observed at the beginning of the course.[1] The difference between these two subjects of study suggests a possible

[1] These two curves may be seen in the author's *Learning by Doing*, pp. 106, 108.

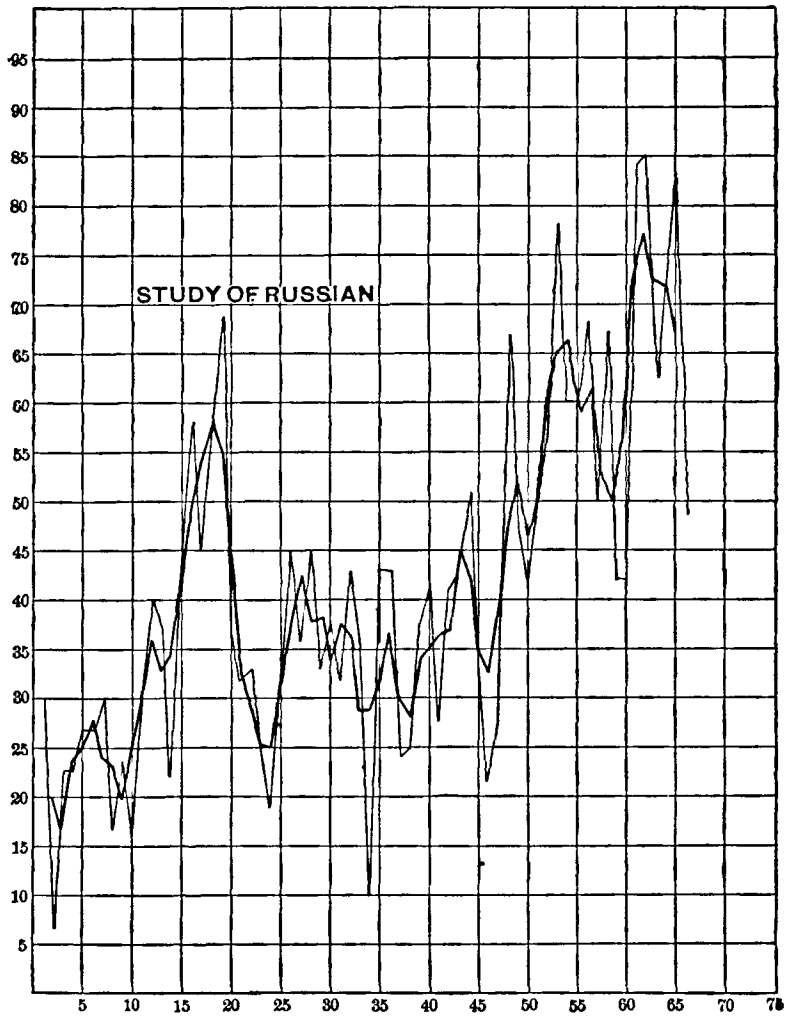
explanation of these plateaus. In introductory psychology the first week or two is generally devoted to discussing a few fundamental facts. The new terms are not numerous. The effort of the teacher is devoted rather to laying the foundation by establishing the simpler principles. Consequently, there is little chance for confusion. In beginning embryology, however, a large number of new words and terms must be mastered at once. This naturally perplexes the student. His progress is therefore slower at the outset than in psychology. He drops almost immediately to a low level of efficiency which reveals itself in his curve of learning as a plateau. What, then, is the cause of this retardation?

The present writer, from his study of the learning process in typewriting and in beginning the Russian language,[1] concluded that these periods of arrest in progress are caused by the need of time for making associations automatic. In typewriting, for example, these associations consist in connections between the letters of words and the location of the corresponding keys of the typewriter. The learner, starting at the zero stage, advances rapidly at first. This initial rapid advance has been found true of all acts of skill and of subjects of study, in which a large mass of new material is not crowded upon the learner at the outset. The writer's investigation of the early stages in learning the Russian language, the curve of which is given below, shows the same characteristic. This curve of learning also indicates the effect of uninstructed learning. It is much more irregular than would have been the case had the learner been aided by a teacher.[2]

Returning to typewriting, it is clear that after a certain very moderate degree of proficiency has been attained

[1] *Psychological Bulletin*, vol. 1, p. 295, vol. 7, p. 149; *Studies in Philosophy and Psychology* (Garman Commemorative Volume), p. 297.

[2] Those who wish more detailed information of the psychology of beginning a language may consult the author's *Mind in the Making*, p. 199.



progress will be slower and gains will be roughly proportional to the strength of the connections between letters of words and their corresponding keys. Establishing these connections requires practice, and for this practice time is

needed. There are, of course, different degrees of proficiency, depending upon the firmness of the connection between letters and keys, and upon the rapidity with which the associations work. Quite soon the hand goes directly to the vicinity of the desired key, but a few seconds will be required to find the right one. Next the finger, directed by the eye, may strike the key at once, and finally the eye is unnecessary, the sense of location being a sufficient guide.

This is a very sketchy description of the stages of learning to use a typewriter, but it answers the purpose. There are different levels of efficiency, each of which must, so to speak, be consolidated before it is possible to rise to the next level. This consolidation requires practice, the amount needed depending upon the number of details to be mastered and upon their difficulty. In the case of certain individuals especially adapted to a given piece of work, progress may be continuous to a high level of efficiency. There are children, for example, to whom the multiplication tables offer no difficulties. They learn them easily and accurately. Young salesmen may also be found, occasionally, who do not need to learn the art of selling goods. They know how to deal with men and can meet each emergency as it arises. But such children and such men are rare. The majority learn with effort, and from time to time they must stop to organize and reorganize what they have learned.

The periods of arrest in progress—the so-called plateaus of the curve of learning—are, then, intervals for consolidating the information or skill won by the learner during his advance, but not well organized because he was too busy making gains. This cessation of progress, however, is only apparent. It is not a real arrest, for during this time the facts and information are being automatized for ready use. Progress seems to be delayed, because it cannot be measured and recorded so as to be visible to the eye. Loosely accumulated information is only partially

usable. It comes to mind slowly and some of it does not come at all until it has been relearned. More than this, the meaning of facts grows as their connection with other facts is observed, and these new relationships give added significance to what one has learned, and make it more serviceable in one's thinking. This requires time—time for the nervous processes underlying the learning to become set and time for new nervous connections which are the basis of recalling ideas to be established and fixed.

In the early stages of learning the real advance is therefore made during the periods of seeming arrest of progress, because it is then that the consolidation of details is going forward. In acts of skill these details are the finer movements, together with the judgment of the amount and direction of muscular effort, and in subjects of study they include facts and ideas which must be both learned and organized. Progress during these plateau-periods assumes, of course, that the learner is a zealous worker. This explanation of these periods of apparent retardation is illustrated by the experience of those who have spent several years in a foreign country trying to learn the language. The first rapid, though slight, advance is attended with a feeling of elation. This, however, is followed by a long period of discouragement. The best endeavors seem to bring no progress. The length of this plateau-period varies with different persons—with their aptitude and preparation for the language—but all feel its oppressiveness. Now, an interesting feature of this plateau is the suddenness with which it often disappears. At times it seems to vanish in a night. The word-associations and peculiarities of thought-sequence had been automatized during the long period when no visible progress was being made. Beginners in golf, again, are only too familiar with the long period of discouragement when they seem to be making no advance. Perseverance finally brings results, but for a long time improvement is intermittent.

Evidence that these plateau-periods are days of automatization is found in the fact that they are always followed by a rapid advance.[1] Since this is a regular occurrence, it must be accounted for, and the explanation of the sudden advance seems to be that something has been going on, during the interval of apparent retardation, to make what has been learned more usable. These periods of delay in visible progress, then—assuming that the learner is working faithfully and intelligently—are the days when real progress is being made, for during that time the skilful movements, or the material of knowledge, as the case may be, are being automatized for instant use.

The latest investigation[2] of learning adds further evidence for the explanation of plateaus as periods of automatization. Batson concludes from his experiments that when progress requires the organization of different movements into a unit, plateaus represent the time needed to establish this serial and unitary combination. In other words, a plateau is the visible expression of the time needed to master or automatize the chain of associated movements which, so long as they require individual attention, produce temporary retardation. Book also seems to accept the principle of automatization when he says that "it takes some time for the new way of writing" [on the typewriter] "to become sufficiently automatic to allow part of the attention to forge ahead in quest of more economical methods."[3] The length of the plateau, excluding physical conditions, *ennui*, etc., will depend upon the number and difficulty of the details which must be co-ordinated and automatized, that is, upon the complexity of the work. Automatization, as has been said, means mastering details sufficiently to make them readily usable. These details consist of whatever is essential to success in the work upon

[1] *Psychological Bulletin*, vol. 7, p. 153.
[2] W. H. Batson, *Psychological Monographs*, no. 91.
[3] *University of Montana Bulletin*, no. 53, p. 155.

which the learner is engaged. If progress requires that separate movements be combined into a series, this serial activity must be practised until the learner need not attend to the separate movements; but this is one phase of automatization.

Complexity, however, is not merely a matter of the activities involved. It is not wholly an objective condition. So far as successful accomplishment is concerned—and this is the psychological problem—the ease or difficulty with which an individual masters the movements makes them for him, at least, either simple or complex. Plateaus do not occur in every learning process. It is doubtful, indeed, whether they are inevitable in every objectively complex process. It is quite conceivable that a learner may have such aptitude for a feat of skill as to master its complexities without any retardation. This was true of one of the subjects of the writer's experiments in tossing and catching two balls with one hand; and this is a fairly complex activity. At the same time plateaus are the rule, and the more complex the combined movements the more likely they are to occur.

The question may well be asked, however, whether these characteristics of learning are true in the case of those preparing to do the world's work. Experiments in the psychological laboratory are sometimes thought to be so artificial and unreal as to be of little value for the outside world of action. Fortunately, tests of those engaged in the world's work have been made, and they have verified and enlarged the results obtained in the laboratory. Some of them may be briefly considered.

Investigation of learning over long periods of time, for example, until, as we say, the apprentice has learned his trade, shows that finally a level is reached above which the man does not rise without putting strenuous effort into his work. This exceptional effort is rarely expended unless new demands and responsibilities are put upon him.

The study of telegraph-operators by Bryan and Harter[1] showed that a new increase in the rapidity of receiving and sending messages begins after an operator is transferred from an unimportant office to the main line. There are, of course, individual differences in the possible rate and range of improvement, but few reach the limit of their ability. This is a phase of the human tendency not to expend unnecessary energy, to which reference was made in an earlier chapter. Man does not exert himself needlessly. That which produces a result satisfactory to the demands of the occasion is good enough.

Aschaffenburg,[2] again, tested four skilled typesetters, with nine, eleven, twenty-one, and twenty-six years' experience, respectively, and found that, under the stimulus of competition and observation they made a marked improvement in the quantity of type set during the four days in which they were tested. A new stimulus was applied and their level of production was raised. It is improbable that these typesetters were exceptional. Indeed, evidence has been found[3] which shows quite conclusively that even with adults who think that they are doing their best, slight incentives materially increase the output. Further, Wright's investigation has demonstrated experimentally that "through the continued use of a stimulus not sufficient to call forth their strongest efforts the subjects accepted the same as a standard, and when they were deprived of this standard objectively, its subjective influence still persisted to such an extent that the total accomplishments of the subject were materially lessened."

This investigation is experimental proof of the *tendency to minimum effort* of which we have already spoken. It shows that man accepts as a standard of efficiency the demands of the situation confronting him—that he is sub-

[1] *Psychological Review*, vol. 4, p. 27, and vol. 6, p. 345.
[2] Kraepelin's *Psychologische Arbeiten*, vol. 1, p. 608.
[3] W. R. Wright, *Psychological Review*, vol. 13, p. 23.

ject to false limits of production and achievement, which he erroneously thinks represent his ability. This is probably true not merely of employees but also of managers. Indeed, observation has led the writer to believe that a good part of the inefficiency of employees reduces finally to the inefficiency of those who direct them. Most men are upon levels of production above which they could rise if the right stimulus were applied. Of course one may feel that it is not worth the effort, but in that case change of occupation is probably desirable. The human tragedy is to settle down, contented, into the animal method of mere adaptation. Rather, find something worth while, then decide upon a definite plan of action instead of drifting into the line of least resistance and expending the minimum amount of effort that will meet the needs of the situation. It is supremely important to find something that one feels is worth one's best efforts. Then learning may be carried to the highest level of which an individual is capable. "Something worth while" assumes an end for which one zealously strives.

This lack of a purpose or end in the work of children has been mentioned by Dewey as one of the causes of inefficiency in the schools. Questions are asked and problems given, the answer to which the teacher is assumed to know. There is no incentive to achievement except the artificial one of rivalry in rapid work. The answers are known, there is no opportunity for disagreement, no mental stimulation of discovery. The difference between the dearth of interest under these conditions and in the presence of a real problem to be worked out, with an end that is worth while, was shown in a country school. There were no books for the English class—the eighth grade—so the teacher[1] decided to let the children "write a book." Each week's composition was to be a "chapter," describing an "adventure" of the hero. Here was a real end,

[1] Miss Claudia Lide, a graduate of Washington University.

something worth doing, something in which originality had free play; and the result far exceeded expectations. Instead of the usual stupid "compositions" culled from encyclopædias, these children put their best efforts into the work. Unused reservoirs of ability were tapped, and some of the productions were so good as to be accepted for publication by editors of magazines with departments for children's stories.

It is commonly thought that the work of adults differs from that of children by this distinction of an end. Unfortunately, this is often not the case. The increased or improved production reveals the difference when a vital end or purpose lures the worker on. Thomas Huxley hated composition until he reached an age when he had something that he wanted to say, and Harriet Martineau says of herself: "I was the first of my family who failed in handwriting; and why I did remained unexplained. I am sure I tried hard; but I wrote a vulgar, cramped, untidy scrawl till I was past twenty—till authorship made me forget manner in matter and gave freedom to my hand." The explanation is that no purpose stirred her till the incentive of authorship took possession. Incidentally, it was observed that the class in the country school, to which reference has been made, improved markedly in the appearance and neatness of their writing under the stimulus of "writing a book." An end that appeals to the learner as worth while is closely related to Thorndike's theory of the influence of satisfaction and annoyance. "In playing golf," he says, "the satisfyingness of the sight of one's ball speeding down the course spreads to make the way one held and moved the club a little more satisfying as a response to the situation which provoked the stroke." [1] Improvement, to be permanent, must result finally in certain habits which constitute the form, tensions, and movements; and satisfaction certainly promotes habit forma-

[1] *Educational Psychology*, vol. 2, p. 188.

tion. Certain obstructions, however, are likely to be in the way.

Monotony is perhaps the most insidious obstacle to progress. It is hard to raise the lower grades of work to the level of achievements. "Begin at the bottom" is a good business proposition. It is also psychological. Man, however, is restless at the bottom. The details do not interest him. Americans, at least, are not much impressed with the importance of beginnings. Were proof of this feeling necessary it could be supplied in abundance from our numerous "finish-quick" institutions. The most that can be said in favor of such places is that they do what they promise. They finish their students and they do it quickly. The short and altogether inadequate courses in medicine, law, and commerce to which young men flock instead of going to well-equipped schools are cases in point. The degree or license to practice is the important attainment, as they view it, not knowledge, training, and skill.

In business probably the most effective antidote for monotony is to make an outlet for success. Blind alleys in occupations are discouraging and discouragement generates drudgery. No visible outlet to one's work, and discouragement, are the conditions that breed monotony. The selection of an occupation is, of course, a supremely important matter, and vocational guidance will justify itself if it merely starts boys and girls to thinking about the vocation in which they would like to engage. As a matter of fact, however, it does much more.

Closely related to monotony is the effort that goes into one's work. Maximum effort is a variable quantity, even in the same person. Temporary "fitness," fatigue from any cause, emotional disturbance, bad air or high temperature lessen the output if not the effort itself. Some of these matters are beyond the control of managers, but not so with the office or factory air; and business men

have not given enough attention to ventilation. In those cases in which the output has been measured under varying conditions of temperature and humidity, these factors have been found significant. Educators have already learned this, but business men have not acted upon the discovery. Human energy is as much a matter of physical and physiological conditions as of the wish to achieve. It is easy to drop into a state of partial relaxation. This, again, is a phase of adaptation; and external conditions should be studiously planned to promote work.

To relax is human. It is an expression of racial indolence. Civilized man is kept at a prolonged high level of activity by the incentives of civilization. The motives are always personal, and prominent among them is the desire to better one's condition. Remove the hope of advancement and effort drops to an easier level. But the psychology of habit also plays an important rôle here. There is always an inclination to return to a lower order of habits. In learning the touch method on the typewriter, for example, one tends to fall back upon sight. It is easier. Consequently, beginners in any line of work should maintain a high degree of alertness until efficient habits become automatic. Then effort is not required to carry them out.

One way of doing a thing is not harder than another. It is habit that makes the difference. Any unhabitual movement, or series of movements, is difficult. Change of habits involves strain, muscular or mental. Flexibility is subject to the same physiological restraints. Effort must therefore be severe and continuous until the new habits that further a higher order of skill are established. The prolonged training needed to produce soldiers is a matter of "fixing" habits. So long as there is danger of dropping back into former modes of action, so long as a given situation does not produce the definite military response, little reliance can be placed upon the men. They must be

trained until they cannot think or act in other terms than those of the soldier; and this thinking and acting must be instantaneous. It must be reflex. "Seasoned veterans" means this as much as it signifies hardened muscles. Such training is only carrying the automatization of complex habits of response to given situations to the highest level of efficiency.

What, then, is the function of instruction in learning? The usual idea of instruction is that it consists in possessing and imparting the requisite knowledge. This, however, is the lowest conception of the art. It ignores the mental condition of the recipient and assumes that a given morsel of knowledge is equally important to different persons and to the same individual at the varying stages of his progress. The same knowledge, however, has different carrying power according to the time when it is imparted. Difficulties arise in an act of skill or subject of study as the learning proceeds. These difficulties present problems, and the learner is keen for the solution. This is the moment when the needed information is welded into knowledge by the learner because his mind is at white heat. He sees its use and he applies it. With the best instruction progress is uneven, with mediocre, even though the instructor be learned in the matter, the inequality is immensely increased.

Irregularity in progress is not due merely to physical conditions to which reference has been made. Progress is usually by sections. Certain efficient habits are acquired, while others equally important lag behind. The writer has recently observed this in golf. He has been trying for months to assume the right form, to keep his eye on the ball, to hold his head still, to avoid pulling or slicing, and to follow through. A few days ago he observed, for the first time, that his eyes remained glued to the ball, and this acquisition has persisted. Yet the other no less important acts remain unlearned. Inquiry among friends

has given corroborative evidence. Their experience has convinced them that certain habits essential to the game are acquired, while others no less needful for success remain stationary. The mental attitude is, of course, important. Young Richard was quite right when he advised little Una, who was struggling to control her fork at her first dinner-party, to keep her mind on her knife and let the fork take care of itself. "Then I began to succeed," she said later, looking back. "The fork was as meek as a lamb if I paid no attention to it." [1] The same observation has been made by a music-teacher who says to her pupils, after something has been clearly shown and unsuccessfully attempted: "Stop trying, and it will do itself." [2]

The mental attitude, however, has a much wider reach. There are several ways in which it may influence progress in learning. Belief that the goal is unattainable, uncriticised and unjustified assumptions regarding the meaning or nature of the work, cause delay and perhaps ultimate failure, while confidence and a mind unhampered by hasty conclusions favor progress. All of these attitudes and still others have been found in learners, and their effect upon the curve of learning has been experimentally tested. The scientific attitude of examining a problem before drawing conclusions, and then of holding these convictions tentatively so that they may be readily changed, as further examination suggests new view-points, is essential to progress. Assumptions, perhaps accidentally made, become intrenched before the learner is aware of it, and distort his judgment. Ruger[3] found that "in general, the solutions" [of problems] "were not the result of mere straightaway thinking, and the consequent formulation of a thoroughgoing plan of action, but were the outcome of an extremely complex interrelation of more or less random impulses

[1] *Una Mary*, by Una Hunt, p. 33.
[2] *The Psychology of Religion*, by Edwin D. Starbuck, p. 117.
[3] *Op. cit.*

and ideas." Incentives are also important, because, as Wright has shown, they act as a mental stimulant.

Here also belongs the "spirit" of the office, shop, factory, or school. The significance of the group sentiment, both in learning and in getting results, can hardly be overstated. It rules with irresistible force. In schools it must be secured as an ally or the work is a failure; and in business it means stagnation followed by bankruptcy, or the enthusiasm that sweeps aside all obstacles. There must, however, be something worth getting enthusiastic over. Group sentiment needs content or it is like the superheated air of which one hears in slang. The hurrah method is empty. When, on the other hand, ideals and purposes with carrying power arouse emotions, and the whole is welded into a sentiment that tolerates no inefficiency, abilities previously unknown even to their possessor are brought into action. There is nothing that so stirs a young man as the feeling which accompanies the belief that he is an essential part of a great organization. In the retail business this feeling pervades the store and gives to it a distinctive tone; and in the factory it means a greater and better output. Yet the increased production is accomplished with less than the usual fatigue, because the mental attitude raises the work above a task. Further, this alertness has been found to be the truest guide in the conscious and unconscious selection of methods in the learning process.

But with all the organization for efficiency there still remains one factor which cannot be organized out; and that is the element of time. It is not for practice alone that time is needed. We shall find later that distributed study yields better results than concentrated work, and Strong[1] has shown that moderate distribution of observations of advertisements makes a more lasting impression

[1] Edward K. Strong, Jr., *Journal of Philosophy, Psychology and Scientific Methods*, vol. 11, p. 124.

than concentrated observations. When four advertisements of one firm "are seen within a few minutes of each other, the four create an impression that is 82 per cent superior to that created by one advertisement. When the four advertisements are seen at intervals of a week the four create an impression 90 per cent greater than did one." The intervals between the advertisements may, of course, be too long. So Strong found that when the interval was lengthened to one month the impression from the four advertisements fell to 45 per cent more than that from one advertisement.

Nerve-cells, when stimulated, continue their activity after the stimulation has ceased. At least this seems to be the explanation demanded by the observed facts. Applying this to a learner's task in any field, if the study of new material is continuous, or if an apprentice seeks to cover ground too rapidly, details accumulate faster than they can be organized and consolidated. Stating it in cerebral terms, the nervous processes that persist after practice or study do not have time to do their work and become "set." Time itself is evidently a factor in learning.

In acts of skill requiring automatization of movements this need of time has been approximately determined, and there is no reason to believe that learning to meet human situations—to judge human behavior—differs in this respect. To be sure, in the latter case associations that have not been noticed may produce the helpful inferences, but the fact still remains that these inferences come only after the lapse of time, and not infrequently when the learner's mind is engaged with quite different thoughts. Consequently, explanation of these inferences by unnoticed associations still leaves open the question of their origin. The answer, again, is the continued activity of nerve-cells. Mental processes are dependent upon the nervous system. If there are disembodied minds hovering about, psychology knows nothing of them. Association

of ideas is primarily a connection or relationship between the activity of nerve-centres and the resulting nervous processes. This relationship is such that when two brain processes occur simultaneously or in succession, the activity of one tends to excite the other.

Association, again, is a mental fact for the sole reason that it is a physiological fact. Assuming, then, as modern psychology does assume, that mental processes never take place unattended by nervous action which is essential to their occurrence, we seem forced to the view of a gradual decrease of this nervous activity, and with it a corresponding diminution of the correlated mental processes, until the nervous activity is of so low an intensity that we have what, for want of a better name, has been called the organic correlate of remembering, associating, etc. There is no other escape from the assumption that "mind" was inserted, *de novo*, at some stage of the developmental process, and this certainly no evolutionist is willing to admit.

This view of the decreasing intensity of nervous activity leads, of course, to subconscious nervous processes, some of which may yield results available for consciousness. This transmarginal field "contains, for example," James once said,[1] "such things as all our momentarily inactive memories, and it harbors the springs of all our obscurely motived passions, impulses, likes, dislikes, and prejudices. Our intuitions, hypotheses, fancies, superstitions, persuasions, convictions, and in general all our non-rational operations, come from it."

The writer is aware that subconscious, or extramarginal, mental processes have been in some dispute because of the vagarious conclusions which unscientific writers have drawn. The belief in some sort of activity outside (beyond or below) the personal consciousness has recently, however, become scientifically respectable.[2] Different

[1] *The Varieties of Religious Experience*, p. 483.

[2] See *Journal of Abnormal Psychology*, vol. 2, pp. 22–58.

names are applied to it, and the views of its nature are various, but there is general agreement that in some way it exerts an influence upon the personal consciousness, affecting opinions, beliefs, attitudes, and behavior. It cannot be otherwise, for cerebral localization and the modern view of mental diseases, indeed all of brain physiology, are unintelligible except on some theory of psychophysical parallelism, and the latter in turn necessarily assumes extramarginal processes. Since their occurrence and connection with the facts of consciousness, rather than their nature, is the important consideration for our present purposes, it does not matter whether they are called "physiological cerebration" or "subconscious mental processes." Now that the existence of extramarginal processes has been admitted, if somewhat hesitatingly, it is not necessary to refer to the unusual instances of crystal vision, automatic writing, and hypnotism for illustrations of their integrative activity. A few days frequently clears the most perplexing problems, though the person may have been guiltless of thinking of them except as they occasionally emerged above the level of consciousness only to disappear again as the work in hand proceeded. The sales manager of a large wholesale house recently gave the writer the following bit of personal experience:

"A few weeks ago I had occasion to make a quotation on a large quantity of goods. The prospective sale amounted to about $200,000. In using a table to arrive at the figures for the unit of the product upon which I was quoting, I found the price figure so high that I used half the price. I also found the size so large that I used half the size. When I made my computation I doubled one figure but forgot to double the other. The result was a price about half of what it should have been per thousand. These prices were accordingly wired to two different companies in the afternoon. The articles quoted on were new to us and, consequently, there was nothing to arouse suspicion

in my mind regarding the inaccuracy of the prices. On going to my home in the evening I found company, and, after passing a pleasant evening, I retired about eleven o'clock, without having thought of the transaction or of the price, so far as I can recall. Certainly no doubt arose in my mind concerning the accuracy of the figures that I had quoted. In the night I awoke suddenly—I afterward noticed that it was about one o'clock—house quiet and lights out. I pushed the electric button and started for the telephone, realizing instantly that I had committed an error of many thousands of dollars on the wrong side of the ledger."

The cerebral processes apparently do their share toward the organization, clarification, and automatization of details, if the material is put clearly before the mind. "A man's conscious wit and will," James once wrote, "so far as they strain toward the ideal, are aiming at something only dimly and inaccurately imagined. Yet all the while the forces of mere organic ripening within him are going on toward their own prefigured result, and his conscious strainings are letting loose subconscious allies behind the scenes, which in their way work toward rearrangement; and the rearrangement toward which all these deeper forces tend is pretty surely definite, and definitely different from what he consciously conceives and determines. It may consequently be actually interfered with (*jammed*, as it were, like the lost word when we seek too energetically to recall it) by his voluntary efforts slanting from the true direction." [1] And again, referring to this subconscious organization of knowledge and experience, James continues, the extramarginal field, "whatever else it may be, is at any rate a place now admitted by psychologists to exist for the accumulation of vestiges of sensible experience (whether inattentively or attentively registered), and for their elaboration according to ordinary psychological

[1] *The Varieties of Religious Experience*, p. 209.

or logical laws into results that end by attaining such a 'tension' that they may at times enter consciousness with something like a burst." [1] This is probably the explanation of sudden revelations, like the thought of natural selection. "The idea came to me," says Alfred Russel Wallace, "as it had come to Darwin, in a sudden flash of insight; it was thought out in a few hours—was written down with such a sketch of its various applications and developments as occurred to me at the moment—then copied on thin letter-paper and sent off to Darwin—all within one week." [2]

The great majority of our judgments and "intuitions" are obtained by this unconscious interaction of extramarginal, cerebro-mental processes; and the function of the "reason" is rather that of criticising the ideas and beliefs which come to us, as Alfred Russel Wallace once said, "We hardly know *how* or *whence*," and of reinforcing those that stand the test. The human mind is at best a very imperfect instrument for thinking. Aside from this imperfection, however, all the data cannot be accumulated at will within a set period. Much of it comes to us unexpectedly through associations started in the marginal and extramarginal region during the lapse of time. "The conclusions at which I have from time to time arrived," says Herbert Spencer,[3] ". . . have been arrived at unawares—each as the ultimate outcome of a body of thought which slowly grew from a germ. Some direct observation or some fact met with in reading would dwell with me, apparently, because I had a sense of its significance. . . . Apt as I thus was to lay hold of cardinal truths, it would happen occasionally that one most likely brought to mind by an illustration, and gaining from the illustration fresh distinctiveness, would be contemplated by me for a while,

[1] *Op. cit.*, p. 236.
[2] *Letters and Reminiscences*, by James Marchant, vol. I, p. 113.
[3] *Autobiography*, vol. I, p. 463.

and its bearings observed. A week afterward, possibly, the matter would be remembered; and with further thought about it might occur a recognition of some wider application than I had before perceived. . . . Again, after an interval, perhaps of a month, perhaps of half a year, something would remind me of that which I had before remarked; and mentally running over the facts might be followed by some further extension of the idea. When accumulation of instances had given body to a generalization, reflection would reduce the vague conception at first framed to a more definite conception; and perhaps difficulties or anomalies passed over for a while but eventually forcing themselves on attention, might cause a needful qualification and a truer shaping of the thought. . . . And thus, little by little, in unobtrusive ways, without conscious intention or appreciable effort, there would grow up a coherent and organized theory."

Evidently, the organizing activity of brain and mind, below the level of consciousness, is an ally of no mean worth, provided the mind is supplied with the material upon which to work. Merely loading it with facts, however, does not produce the result. In reading or studying, the subject-matter should be systematized to the best of the learner's ability. Questions and problems must be clearly thought if the mind is to do its share toward furnishing the solution. Whatever thinking one does should be orderly. A clear-cut error may lead to truth, but mental confusion never. Force a conclusion or belief back against the wall, doubt its accuracy, cross-examine it, tear its inferences from it; then leave it to its fate, and before many days its truth or falsity will be revealed; and this subconscious cerebral activity is of inestimable importance for learning so far, at least, as knowledge, experience, prejudices, and "intuitions" bear upon our present opinions or the acquisition of new view-points.

Learning, then, we have found to be largely an uncon-

scious process. In acts of manual skill new ways of securing results are happened upon accidentally and adopted. The learner then becomes conscious of their value for the work in hand. It is the trial-and-error method, in which the useless movements are gradually eliminated.

In mental activities the same unconscious adoption of methods of improvement is observable; and in thinking we tend to accept the ideas, beliefs, and opinions which surround us. The conventional views of "our set" are compelling; but "our set" is not altogether local. It includes those of our social standing, respectability, conservatism or radicalism, with whose views we are constantly confronted in the newspapers that we take and the books which we read.

Efficiency requires that the selection of ways and means, as well as of ideas and beliefs, be more conscious and intelligent. Methods of improvement will continue to come accidentally, for this is the nature of the learning process. We should, however, be critical in accepting and adopting them, since only in this way can progress be continuous.

Intervals of cessation of progress are likely to occur in complex acts of manual skill, and at this time practice is especially important. The mind should be active during the practice, in order that errors may be more quickly eliminated and the most effective improvements chosen.

There should be periods of rest in everything—in manual skill that the movements may become "set," and in mental activity to give new ideas a chance to assert themselves. A man who continuously works at white heat will not secure the results that will be obtained by one who stops at times to deliberate. An efficiency expert once told the manager of a large business that his chief defect was lack of leisure moments in which calmly to view his problems. This expert, by observing many men, had discovered one element of efficiency which psychologists have found in their laboratory experiments.

Finally, a man having acquired a degree of efficiency that meets the minimum requirements of his position and enables him to hold it, settles down at that level. He may be capable of much greater achievements, but the situation does not demand more energy. So he does not expend it. We cease to form new habits when no incentives for improvement stir us; and the amount of mental energy expended is as much a habit as is the quantity of physical energy applied to doors with check attachments. There is always adaptation to the needs of situations, but parsimony continually operates. We thus act below our ability unless the conditions force exceptional effort.

CHAPTER V

FATIGUE AND ITS PSYCHOLOGY

MUSCULAR and mental activity are always accompanied by liberation of energy and disintegration of tissue. A man gives out more than three and one-half times as much carbon dioxide per minute when walking at the rate of two miles an hour than when asleep. If his pace is quickened to three miles an hour he discharges more than five times as much, and when working in a treadmill nine times as much is given out as when asleep.

This making and remaking of the tissues of the body is a continuous process during life. "Did we possess some optic aid," says Foster, "which should overcome the grossness of our vision, so that we might watch the dance of atoms in this double process of making and unmaking in the living body, we should see the commonplace, lifeless things which are brought by the blood, and which we call food, caught up into and made part of the muscular whorls of the living muscle, linked together for a while in the intricate figures of the dance of life, giving and taking energy as they dance, and then we should see how, loosing hands, they slipped back into the blood as dead, inert, used-up matter. In every tiny block of muscle there is a part which is really alive, there are parts which are becoming alive, there are parts which have been alive but are now dying or dead; there is an upward rush from the lifeless to the living, a downward rush from the living to the dead.

"This is always going on, whether the muscle be quiet and at rest or whether it be active and moving. Whether the muscle be at rest or be moving, some of the capital of living material is always being spent, changed into dead waste, some of the new food is always being raised into

living capital. But when the muscle is called upon to do work, when it is put into movement, the expenditure is quickened, there is a run upon the living capital, the greater, the more urgent the call for action. Moreover, under ordinary circumstances, the capital is spent so quickly, during the action, that it cannot be renewed at the same rate; the movement leaves the muscle with an impoverished capital of potential stuff, and a period of rest is needed in order that the dance of atoms of which I just now spoke may make good the loss of capital and restore the muscle to its former power." [1]

Drawing on the capital of living matter, if the expenditure be in excess of production, brings fatigue. The causes of fatigue are chemical conditions resulting from changes within the organism. Certain substances essential to the activity of the protoplasm have been consumed in this activity, and waste products have accumulated. Oxygen and carbohydrates have been consumed. The chief source of the energy of muscles is carbohydrates. Experimentally, it has been shown that removal of most of the carbohydrates from the body of an animal produces symptoms of fatigue without exercise. Recovery may be brought about by feeding sugar. It is well known that mountaineers, and soldiers on a long march, are greatly strengthened by eating chocolate. Oxidation of carbohydrates results in the production of certain substances which act as poisons to the body. They are spoken of as "fatigue substances." Two of these substances, carbon dioxide and lactic acid, investigation has shown, are hostile to protoplasmic action. When present in considerable quantity they weaken the sensibility of muscle and diminish its response. A muscle so affected requires more prodding for a given piece of work. Indeed, a muscle treated with either of these substances is "fatigued" without having done any work.

[1] Michael Foster, *Nineteenth Century*, vol. 34, p. 337.

Fatigue, according to Starling,[1] probably depends upon two factors: First, upon "the consumption of the contractile material" [of the muscle] "or of the substances available for the supply of potential energy to this material," and second, upon "the accumulation of waste products of contraction."[2] Although "a state which cannot be distinguished from fatigue can be produced in fresh muscles, by the injection of aqueous extract of the fatigued muscles of another animal,"[3] and although "fatigue may be artificially induced in a muscle by 'feeding' it with a dilute solution of lactic acid, and again removed by washing out the muscle with normal saline solution containing a small percentage of alkali,"[4] fatigue is not primarily in the muscles. This is proved by the fact "that direct stimulation of muscle will cause contraction after the synapse between nerve and muscle has lost its excitability."[5] It has also been observed that a motor centre which has been fatigued for one reflex may be unaffected for another. "This state of fatigue is, accordingly, situated in some synapse, not in the efferent neurone itself."[6] Further, it has been as clearly shown that it is not in the nerves as that it is not in muscle. "In fact it is not possible to demonstrate any phenomena of fatigue in the nerve-trunk."[7]

Considerable evidence has been offered for locating fatigue in the synapse. "The lines of junction of nerves with other parts seem to be more readily fatigued. Nerve-

[1] *Principles of Human Physiology*, p. 209.

[2] Starling seems unmindful of Verworn and Dolley's "fatigue of excitation" and "fatigue of depression"; *i. e.*, fatigue caused by the consumption of reserve material from which the energy of the nerve-cell is derived, and the accumulation of waste products more rapidly than the nerve-cell can eliminate them.

[3] A. E. Schäfer, *Text-Book of Physiology*, vol. II, p. 389.

[4] Ernest H. Starling, *op. cit.*, p. 209.

[5] William M. Bayliss, *Principles of General Physiology*, 1915, p. 451.

[6] William M. Bayliss, *op. cit.*, p. 475.

[7] Ernest H. Starling, *op. cit.*, p. 259.

cells, or the fields of conjunction in the central nervous system, seem to be markedly susceptible to fatigue," so "we may assume that the seat of the fatigue is to be sought either in the central nerve-cells or in the nerve network, 'synapses,' in relation to them."[1] Evidence that the nerve-cell is the seat of fatigue has been given by Piper,[2] who has shown that fatigue causes a decrease in the rate of oscillatory discharge of the nerve-cell. It has been known for some time that fatigue substances act in a stimulating manner upon the respiratory centres, quickening the rate and increasing the depth of respiratory movements.

The primary seat of fatigue, then, appears to be either in the nerve-cell alone, or in both the nerve-cell and synapse. However this may be, originating in one tissue, it spreads through the blood circulation to other tissues and quickly becomes a more or less general condition of the body, affecting all organs. That fatigue products become a part of the general circulation is indicated by the fact that the introduction of blood from a fatigued dog into the circulation of one that is fresh will produce all the symptoms of fatigue. "There is every reason to believe," says Lee,[3] "that the main principles of muscular fatigue are demonstrable in other tissues and organs of the body—that in them also fatigue is characterized physically by a diminution in working power, and chemically by the destruction of energy-yielding substances and the appearance of toxic metabolic products. Diminution of working power is manifested in very different ways by diverse tissues. Glands in fatigue seem to secrete less than when fresh, and it may be that the action of digestive juices is diminished. The kidneys may be deranged, so that their epithelium is unable wholly to prevent the passage of al-

[1] William Stirling, *Outlines of Practical Physiology*, 1902, pp. 300, 303.
[2] H. Piper, *Elektrophysiologie menschlicher Muskeln*, 1912, pp. 124 *ff.*
[3] *Popular Science Monthly*, vol. 76, p. 182.

bumin from the blood to the urine. A fatigued heart is dilated, its beats are quickened and may become irregular, and its diastole, or resting period, may become abbreviated."

Since fatigue expresses itself in the tissues and organs of the body, the vigor of these organs is evidently an important matter; and any means of increasing their endurance has psychological significance. No apology, therefore, is necessary for referring to muscular exercise in the psychology of the day's work. The intimate relation between the mental and physical has long been recognized. Intelligence in animals is correlated with the range in muscular co-ordination, and the more complicated the neuromuscular apparatus the greater the intelligence of the animal. In man, intellect, feelings, and will are closely related to alterations in the circulation of the blood in the body as a whole, as well as in the brain; and it is only under the influence of exercise that the circulation maintains its highest degree of vigor. The so-called power of the will is dependent in some degree upon the firmness of muscle, or, at any rate, upon the bodily tone; and sensitive mental response bears a direct relation to vigorous bodily reactions. So far as fatigue itself is concerned, this relation is even more clearly discernible. Weariness, however, whether mental or physical, is a relative matter. Some men are never fatigued, though they do a prodigious amount of work.

The explanation of indifference to fatigue is found in the relation between expenditure of energy and the amount on deposit. Incessant change in bodily processes is characteristic of life. This change may be sluggish or it may be rapid—if too slow, the tissues and organs of the body are not properly renovated; and if too rapid, tissues are broken down faster than they can be rebuilt and bodily deterioration ensues. The chemical processes of the body should proceed as rapidly as an orderly reconstruction of

the tissues permits. Fatigue is a sign that one is going too fast. But it should be observed that the rate of activity, again, is a relative matter. The important question is not how much one is spending but what is the ratio of expense to one's bank-account. Though the average amount of a man's work is about two million foot-pounds per day, Miller, the winner of the 1898 six-day bicycle-race, performed more than fifteen million foot-pounds of work on the first day, as calculated by Carpenter, and he averaged on each of the six days more than nine and a half million foot-pounds, which is approximately five times the daily average of men. But more than this, during the month following this tremendous expenditure of energy Miller again competed, this time in a twenty-four-hour race, and two months later he broke his previous record, winning another six-day race.

Of course few engage in competitive contests of just this sort, but well-developed organs mean much for endurance in other fields than those of the race-track. "Voluntary and involuntary muscles should possess size, toughness, and contractile power sufficient for both ordinary and extraordinary demands. The heart should be able to resist a high blood-pressure without detriment to its muscle-fibres or valves. The capillary bed should be capacious. Vasomotor response should be ready. Respiratory organs should be capable of quickly bringing in oxygen and quickly eliminating carbon dioxide. Osmotic exchange should be rapid. Secreting and excreting organs should be quickly supplied with blood and lymph and capable of quickly supplying their products." [1]

Preparedness for possible emergencies is important here as in everything else, since preparation for the exceptional is excellent equipment for the usual. To almost every one come days of strain. Demands are suddenly put upon us, and the ease and success with which we accomplish

[1] Frederic C. Lee, *Science*, new series, vol. 29, p. 521.

them depend upon our readiness. The reconstructive adaptation of the human body to the calls made upon it is one of the remarkable biological facts. But there should always be a margin of safety, and this requires that strength be kept at a high level of vigor. "Moderate but increasing amounts of exercise, producing moderate but increasing amounts of fatigue substances, put the tissues into a state of tolerance or resistance, such that when the supreme effort is demanded of them they do not succumb. He who wins is he who can best resist the poisons of fatigue."[1] Training consists, among other things, in producing resistance to fatigue products.

It has long been known that organisms may become immune to toxic substances by growing accustomed to gradually increasing quantities. Illustrations of physiological immunity are abundant, and they are important because they show the extent to which resistance, in the matter of which we are speaking, may be developed. A man may gradually increase the dose of arsenic until he can take enough to kill ten men. His adaptation to this drug is now so perfect that if he suddenly stops taking it he will die. In other words, to accustom him again to the normal conditions of human life the dose must be gradually decreased until his organs have readjusted themselves to its absence. Adaptation to the poisons of venomous snakes may also be artificially produced by gradually increasing the amount given. Such a man may then live among these poisonous snakes without danger to his life.

In the same way immunity to the poisons of fatigue substances may be developed. Excess in anything is debauchery, but in the matter of physical exercise excess varies with individuals. What tires one is insufficient for the well-being of another. The physical strength of some is abundant and of others insufficient. One should endeavor to extend the boundaries of one's endurance, always

[1] Frederic C. Lee, *op. cit.*

stopping before exhaustion is reached, but doing a little more the next day. The muscles of the heart should be strengthened by exercise, just as those of the arm should be hardened. A man with unhypertrophied heart and muscles is a mollycoddle who cannot stand strain when it is put upon him.

The test of "fitness" is the capacity to continue active unfatigued. The curve of fatigue for any particular day is to a certain extent a gauge of the bodily and mental condition at the time. The night's rest, digestion, emotions, all of these influences and others that are not so obvious, greatly influence the ability to do work and largely determine the sort of work done, its accuracy and value. The most important factor in producing fitness, however, because of its far-reaching effect upon the body and mind, is probably exercise. With moderate exercise there is no evidence that any other substance than carbon dioxide is formed, but with violent exercise lactic acid is also produced. A variety of experiments indicate that lactic acid appears with a relative deficiency in the supply of oxygen to the contracting muscle. The copious intake of oxygen that accompanies exercise would tend, therefore, to reduce the lactic-acid formation. Respiration is essentially a gaseous exchange and takes place primarily in the cell. For these reasons, and since muscle in an atmosphere of pure oxygen does not fatigue as soon as in an atmosphere of nitrogen, and a muscle stimulated to exhaustion in an atmosphere of nitrogen recovers quickly in pure oxygen, it would appear that the presence of oxygen tends to push back the fatigue-point. All of this suggests the value of volumes of fresh air in delaying fatigue and of furthering recovery when fatigue has set in.

"The practical importance of muscular exercise upon the processes of oxidation in the body cannot be overestimated in these days when overcivilization tends to weaken the physique and moral fibre of man. There is no

other condition, whether it be physiological or pathological, which will produce such a great increase in the absorption of oxygen and the discharge of carbon dioxide, such a wide-spread effect upon the exchange of material in the body. Man in a primitive condition is forced to muscular exercise in order that he may obtain food or protect himself from wild animals, or more often from his fellow men. Civilization cannot override in a generation or two the characteristics impressed through countless ages, and the need of exercise becomes imperative and finds satisfaction in sport, when, owing to the process of division of labor, some classes become differentiated for work necessitating but little muscular activity. . . . One of the marked characteristics of life is oxidation, but the benefits of muscular work are not to be attributed to that alone. Muscular activity is not a simple increase of oxidation; the body is not a machine from which work can be obtained simply at the expense of more fuel and increased wear and tear. The co-ordination of all the systems of the body is necessary, and all parts are affected; the growth and vitality of the body are favored by the work performed. In these respects muscular exercise is of the utmost importance, and one may see in the training for warfare among the highly civilized and especially the manufacturing nations a blessing in disguise. Should the danger of war ever be entirely removed the only safeguard against degeneration would be outdoor sport." [1]

Unfortunately, physical activity is too commonly regarded as the luxury of play. The belief is somewhat wide-spread, especially in the United States, that muscular exercise is unnecessary and perhaps undesirable after a man has reached the sixth and seventh decade of his life. To be sure, the popularity of golf has, to a certain extent, changed this opinion, but, after all, a comparatively small

[1] *Recent Advances in Physiology and Bio-Chemistry*, edited by Leonard Hill, 1908, pp. 497 *ff*.

proportion of these older men play the game. The expense, time, and output of energy needed are resistances to which those advanced in years readily yield, and walking, as well as gymnasium exercise, are felt to be uninteresting. Consequently, these men give themselves up to the physical and mental disintegrating processes of age. The effect of regular exercise in developing the bodily organs and in promoting resistance to fatigue, even in those advanced in years, is seen in an instance cited by Sargent.[1] "Mr. Smith Robertson, of Eau Claire, Wisconsin, a man 5 feet 8 inches in height, and weighing 140 pounds, began systematic exercise with 10-pound dumb-bells and a horizontal bar when sixty-nine years of age. He worked with this apparatus for about ten minutes a day, and walked from four to six miles a day regularly for a period of three years. · At the end of this time he found that his weight had increased from 140 to 160 pounds, his chest measurement had increased from 36 to 40 inches, and all the other muscles of the body proportionately; and at eighty-three years of age he could walk or run almost as easily and with apparently the same elasticity as fifty or sixty years before."

Another striking illustration of the value of muscular exercise is Edward Payson Weston. In childhood he was weak and sickly, and as he grew older he displayed no particular athletic ability and had little endurance. At about eighteen years of age fear for his health caused him to turn to walking. A few years ago, at seventy-two years of age, he walked from New York to San Francisco, a distance of four thousand miles, in a few hours more than one hundred and four days. Not satisfied with this record, he walked back from Los Angeles to New York, about three thousand six hundred miles, in ninety-five days.

One of the valuable contributions of the entry of the

[1] *Physical Education*, by Dudley A. Sargent, pp. 63 *ff.*

United States into the present war is the discovery of the value of strenuous exercise. The young men come home on their furloughs so completely made over as to be hardly recognized by their friends or themselves. Thin boys have taken on the right amount of flesh, and the fat have become normal. And with it all has come a hardening of the muscles that has altered their feelings, thoughts, and acts. They have gained a little sweetness and some light.

Physical exercise as a means of acquiring resistance to fatigue has received too little attention, and the value of medicine has been overestimated. "It is well known that a man 'in training' has greater endurance than one who attempts exertion without previous systematic exercise or training. In general, it may be said that a person in the 'pink of condition' is fit not only for physical but also for mental exertion. The great majority of adults are far from being 'in condition,' suffering either from lack of exercise or from too much exercise. The ordinary man errs either in one direction or the other. The brain worker lives too sedentary a life, while the manual worker, through fatigue caused by long hours, is in a continual state of overexertion. Could these conditions be remedied, endurance, as measured by capacity to withstand prolonged strains, might be greatly increased.

"Experiments have shown that physical endurance can be doubled by dietetic causes alone, or doubled by exercise alone. By both together it is not unlikely that it could be tripled or quadrupled. But when it is said that the endurance, or capacity for exertion, of the ordinary healthy man could be thus multiplied, it is not meant that the hours of his daily work, or even his daily output of work, could be increased in such a ratio. What it does mean is the removal of the fatigue limit, a freer and more buoyant life, and a visible increase in the quantity and quality of work per hour. In an ideal life fatigue would be seldom experi-

enced. But in most lives, unfortunately, fatigue is a daily experience." [1]

Probably few men actively engaged in earning their living know the feeling of this buoyant life. The stress of business and of professional problems to be solved, and the worries of making ends meet, keep them at best balancing on the edge of fatigue. They are unacquainted with the freedom that clears away the mental haze and gives constructive visions and insights which cannot be obtained when the fatigue limit is approached. They are content with living in the conventional state of "good health."

The difference between being "well" and thoroughly "fit" has been splendidly characterized by Fisher. "When a person is free from all specific ailments, both serious and minor, he usually calls himself 'well.' There is, however, a vast difference between such a 'well' man and one in ideally robust health. The difference is one of endurance or susceptibility to fatigue. Many 'well' men cannot run a block for a street-car or climb more than one flight of stairs without feeling completely tired out, while another 'well' man will run twenty-five miles or climb the Matterhorn from pure love of sport. The Swiss guides, throughout the summer season, day after day, spend their entire time in climbing. A Chinese cooly will run for hours at a stretch. That the world regards such performances as 'marvellous feats of endurance' only shows how marvellously out of training the world as a whole really is. In mental work some persons are unable to apply themselves more than an hour at a time, while others, like Humboldt or Mommsen, can work almost continuously through fifteen hours of the day." [2]

The source of muscular energy is, of course, important

[1] Irving Fisher, *Bulletin 30 of the Committee of One Hundred on National Health*, p. 44.

[2] *Ibid.*, p. 40.

in connection with ability to work and to avoid fatigue. The evidence here is quite clear. Fisher and Fisk report[1] an experiment made to test the popular idea that meat is especially "strengthening." "The experiments consisted of endurance tests made on forty-nine persons representing the two types of dietary habits. . . . The experiments furnished a severe test of the claims of the flesh abstainers. Two comparisons were planned, one between flesh-eating athletes and flesh-abstaining athletes, and the other between flesh-eating athletes and flesh-abstaining sedentary workers. The results would indicate that the users of low protein and non-flesh dietaries have far greater endurance than those who are accustomed to the ordinary American diet. . . . Similar results have been found in other investigations. It is probable that the inferiority of meat-eaters in staying power is due primarily to high protein and not to meat *per se*."

Experiments on vegetarians and meat-eaters in the University of Brussels gave similar results.[2] The tests were largely comparisons of strength and endurance. As regards strength, little difference was discovered between vegetarians and "carnivores." In endurance, however, a striking difference was found, the vegetarians surpassing the carnivores from 50 to 200 per cent.

Though meat does not give the strength and endurance that it has been thought to furnish, it is doubtful whether its sudden exclusion from man's dietary is desirable. As Pavlov has shown, meat is one of the most peptogenic foods. It seems to stimulate the stomach, and while this excitation may be to a certain extent artificial, some stomachs seem to require it at least occasionally. Perhaps the safer course is to indulge when the craving is felt. The mistake is in regarding it as an essential article of daily diet.

[1] *How to Live*, pp. 197 *f.*

[2] *Enquête Scientifique sur les Végétariens de Bruxelles*, by J. Ioteyko and V. Kipiani, 1907.

Chittenden believes that the waste products of foods containing an excessive quantity of protein, conspicuously meat, is one of the causes of fatigue. His dietetic tests made on men in various occupations are remarkably suggestive. "Nowhere in the literature of nutrition do we find an experiment so painstaking and accurate, covering so long a period, with a diet of so low a protein content following a normal diet," says Benedict.[1] "But," continues the same writer, "it has not been incontrovertibly proven that such a diet could be advantageously adopted for all time, nor that the apparent improvements were due entirely to the low protein. . . . Dietary studies all over the world show that in communities where productive power, enterprise, and civilization are at their highest, man has instinctively and independently selected liberal rather than small quantities of protein." Lusk also takes a similar view. He quotes Rubner approvingly, who, he says, "believes that there should always be an excess of protein constructive material, so that if after physical exhaustion there is depletion of the glycogen reserves, under which circumstances the wear and tear on the cell protein is increased, there may be building units in reserve to quickly restore the tissue destroyed."[2] This question of diet, however, seems not yet closed.

The evidence indicates that, while muscular work can be done at the expense of any of the foodstuffs, carbohydrates are the most available source of muscular energy, and the brain requires the same food as the other cells of the body. Carbohydrates include starches and sugars. Each plant has its own kind of starch, and the grains and potatoes are starchy foods. Protein, found in lean meat, fish, milk, eggs, and cheese, supplies building material. Corn and the cereal grains, with the exception of rice, also contain protein matter. It would be possible to eat noth-

[1] *American Journal of Physiology*, vol. 15, p. 418.
[2] Graham Lusk, *The Fundamental Basis of Nutrition*, 1915, p. 32.

ing but protein, but the system would be overloaded with protein waste. Enough protein should be eaten for building material, and carbohydrates and fats should be taken for energy foods. Fats produce more than twice as much heat as the carbohydrates, so the Eskimo and others who live in cold climates eat chiefly protein and animal fat. Those in warm climates, on the other hand, live largely on carbohydrates, vegetable proteins, and fruits. Theoretically, either one of the energy foods with protein would sustain life, but for practical reasons, such as digestion, it is better to take both carbohydrates and fats. Fat is also valuable as a food, because man is more prone to certain diseases, among them tuberculosis, if the amount of fat in the diet is too limited.

The weight of opinion seems to be increasingly favorable to protein reduction, but the purposes of nutrition must not be forgotten. These purposes Lusk has put in a striking way. "The workshops of life," he says, "require fuel to maintain them, and a necessary function of nutrition is to furnish fuel to the organism that the motions of life continue. Furthermore, the workshops of life are in a constant state of partial breaking-down, and materials must be furnished to repair the worn-out parts. In the fuel factor and the repair factor lie the essence of the science of nutrition."[1] But fuel and repair do not exhaust the subject of nutrition.

"The statement that a diet composed of the five classes of foodstuffs—proteins, fats, carbohydrates, salt, and water —is all that is necessary for the maintenance of life is not strictly true. . . . It seems that in addition to the five classes of foodstuffs, minimal quantities of certain other substances are necessary in order that the processes of life may proceed normally. How these substances act we do not know, but we must imagine that they have a drug-like effect on some organs of the body, and take the place of or give rise to some of the hormones which are

[1] *Op. cit.*, p. 4.

essential for the orderly working of the different organs of the body."[1] These vitamines, as they are called, are present in the juices of fruits, fresh vegetables, eggs, peas, beans, milk, and in the outer layer of grains. Since they are destroyed by excessive heat, the best sources from which to obtain them are uncooked vegetables and fruits.

"Men and horses work best when they are well fed, and feed best when they are well worked. Work creates a craving for food, and thus assists digestion and absorption. Here is a natural stimulus to the appetite, more potent than any drug; it is known to some, but many will not be cured of their ailments by muscular work; they seek some miracle-working drug, or the waters of a fashionable health-resort, where they are unconsciously made to take exercise and lead a more natural life."[2]

We have been considering some of the conditions of physical and mental vigor. Let us now turn to the effect of normally continuous work. At first one's power of work increases, then continues at its maximum, and if the work is continued one's efficiency gradually diminishes. Sometimes the efficiency may be maintained beyond the normal period by increasing the stimulus. We may drive ourselves in one way or another. But even under stimulus the time finally comes when we are no longer able to keep at a high level of production. The first delay is observable in the time required to get "warmed up" to the work. This preliminary warming up is noticed alike in physical and mental work. It is well known "that at the commencement of exercise or muscular work there is often absent even in the trained man that smoothness in the coordination of the muscular contractions, respiration, and circulation, which comes after a short time, and is expressed in the colloquial language of the laborer as 'getting into the swing of the work.'"[3]

[1] Ernest H. Starling, *op. cit.*, p. 652.
[2] Leonard Hill, *op. cit.*, p. 502.
[3] Leonard Hill, *op. cit.*, p. 501.

Practice and skill also reduce fatigue in intellectual activities. Mental work of a very simple nature frequently produces exhaustion in those unaccustomed to using their minds in such a manner. MacCauley, who investigated the Seminole Indians of Florida,[1] has given some interesting information regarding the mental fatigue of these people. It should be noted, first of all, that in MacCauley's opinion the Seminoles rank in the first class of American aborigines. "They seem to be mentally active. . . . In their intercourse with one another they are, as a rule, voluble, vivacious, showing the possession of relatively active brains and mental fertility. Certainly, most of the Seminoles I met cannot justly be called either stupid or intellectually sluggish." To test the effect of continuous moderate mental activity on people unaccustomed to it, one of the men was kept busy for the greater part of the day answering questions. "Occupying our time with inquiries not very interesting to him, about the language and life of his people, I could see how much I wearied him. Often I found by his answers that his brain was to a degree paralyzed by the long-continued tension to which it was subjected."

Mosso, with the effect of practice and skill in mind, investigated the fatigue of soldiers who were learning to read and write. The result of the study of these men was of great importance to them because moderate success shortened the time of military service. One of the officers to whom Mosso wrote for information replied: "At the class examination at which soldiers have to give proof that they are not illiterate in order to obtain their discharge, I have often seen great, strong men perspire until drops of sweat fell upon the paper. At Lecco I saw one faint during the examination, then, feeling better, demand another trial; but on the threshold, at sight of paper and book, he turned pale and fell into a fresh faint." [2]

[1] *Annual Report of the Bureau of Ethnology*, 1883–1884, p. 493.

[2] *Fatigue*, Drummond's translation, p. 121.

Activity, even of a practised and habitual sort, however, tends to produce fatigue, when the work is done under unfavorable conditions. Walking is automatic, but if shoes or boots are uncomfortable, effort to avoid the pain brings into action muscles commonly unused. "Work which is performed painfully by man or beast is uneconomical. The truth of these statements has been fully demonstrated by the successes and failures of forced marches. Pain is beneficent; it is a warning, a natural safeguard, an incentive to rest; the sensations of pain may be neglected, or may be deadened by drugs, and work can be performed, but it is extravagant work, and the penalty has to be paid sooner or later." [1]

"Fatigue is also accompanied by an extravagant metabolism; from this cause the output of carbon dioxide may be increased even as much as 21 per cent. An abnormal rise in the temperature of the body is produced by excessive and prolonged work under unfavorable conditions, and apparently causes a further extravagant combustion." [2]

The amount of fatigue, however, bears no direct relation to the work done. Much depends upon the condition of the muscle. It was shown in Mosso's laboratory that a fatigued muscle suffers more harm from a light task than an unfatigued one from much more severe work, and, in the unfatigued muscle at least, the expenditure of energy during the first half of a period of work is considerably less than during the second half. Vigorous, unfatigued muscle has a certain amount of available energy which may be drawn upon, but a fatigued muscle uses energy needed for other purposes. The difference is much like using one's bank-account instead of withdrawing money from one's business. But, in addition to the muscle exhausting its reserve of energy when work is continued beyond the fatigue-point, the nervous system performs its part with a more intense and wasteful expenditure. Under these conditions, however, nervous energy is not merely squandered. The

[1] Leonard Hill, *op. cit.*

[2] *Ibid.*, p. 501.

irritation that accompanies fatigue leads to a breaking-down of nervous structures. The energy utilized in the contraction of muscle is derived from chemical changes occurring in the muscle, and muscular exercise increases the intake of oxygen as well as the output of carbon dioxide. Since no correspondingly significant changes are observed in the nitrogenous metabolism, it appears that the energy for muscular contraction is derived largely from the oxidation of carbohydrates. "In excessive work, as opposed to normal vigorous work, there is evidence of a certain amount of nitrogenous breakdown of the structure itself." [1] This is due to the wear and tear of the machinery. Overwork tends to destroy muscle-substance.

We said that the expenditure of energy during the first half of a period of work is less than during the second half. This is true even when more work is done during the first part of the period than during the second half. Mosso found in testing muscles that, if the work is reduced by one-half, the time needed for rest is only a quarter of the time required for recovery when the full amount of work is done. Further: "From this experiment . . . ," he says, "it appears that if the energy of the muscle is not completely exhausted, that is to say, if the final contractions are not made, the fatigue is much less, and the muscle is able to perform more than double the amount of mechanical work which it would do if it worked to the point of exhaustion with the most favorable conditions for repose." [2] Probably this is approximately true of the mind as well as of muscles. That is, if work is not carried to the point of exhaustion, the necessary periods of rest are shortened, and the amount of work finally accomplished is much greater than when the work is carried to the point of extreme fatigue, with longer periods of rest under exception-

[1] William M. Bayliss, *op. cit.*, p. 449.
[2] *Op. cit.*, pp. 152 *ff.*

ally favorable conditions for repose. Wimms,[1] for instance, found that short rest-pauses are more favorable in hard mental tasks than in easier ones.

Vigorous, unfatigued muscle is indifferent to the work that it does, provided the work is within the limit of its capacity. When, on the other hand, the energy of a muscle is depleted, release from even a small part of the work is a relief. Amateur mountain-climbers well know the anguish of the last half-hour, though the preceding four hours, requiring perhaps more labor per mile, brought only joy. This is also true of the mind. Experience shows that a robust mind is dauntless. But let one's energy become diminished, and escape from small matters seems like release from an unbearable burden. In other words, the intensity of fatigue bears no definite relation to the amount of work done.

We have spoken of the striking effect of very slight additions to the stimulus when fatigued, and reference was made to the strain of the last part of a mountain-climb. On the mental side this is especially noticeable when one is recovering from sickness. Under these conditions even conversation is fatiguing. Cerebral activity decreases, and one is slow to get the meaning of what one reads or hears. But irritability increases. Sounds and noises ordinarily unnoticed are annoying. Francis Galton relates an interesting experience of his own.

"A few years ago I foolishly overworked myself, as many others have done, misled by a perverted instinct, which goaded to increased exertion instead of dictating rest. The consequence was that I fairly broke down, and could not for some days even look at a book or any sort of writing. I went abroad, and, though I grew much better and could amuse myself with books, the first town where I experienced real repose was Rome. There was no doubt of the influence of the place—it was strongly

[1] *British Journal of Psychology*, vol. 2, p. 153.

marked; and for a long time I sought in vain for the reason of it. At length, what I accept as a full and adequate explanation occurred to me—simply, that there were no advertisements on the walls. There was a picturesqueness and grandeur in its streets which sufficed to fill the mind, and there were no petty distractions to fret a wearied eye and brain." [1]

There are several causes for the lack of correlation between fatigue and the quantity of work done. First of all, as has already been said, comes the effect of the emotions. It makes an immense difference whether a man enjoys his work or not. "A man with no interest is rapidly fagged. Prisoners are well nourished and cared for, but they cannot perform the task of an ill-fed and ill-housed laborer. Whenever they are forced to do more than their usual small amount they show all the symptoms of being overtaxed and sicken. An army in retreat suffers in every way, while one in the advance, being full of hope, may perform prodigious feats." [2]

The effect of the emotions upon fatigue shows that the vocation which a young man selects means much more than the financial returns. His ability to put his work through depends upon his working capacity, and the latter draws its energy in no small degree from his enjoyment of what he is doing. In the matter of exercise, again, the value is not gained merely from using the muscles, but the service is greatly enhanced by the bodily thrills that come only with zest for the activity. Just as food should be palatable to serve best its purposes, so exercise needs to be enjoyable.

We have said that fatigue dulls comprehension. It also weakens the memory. The writer has observed that his memory of facts and names deteriorates markedly after a mountain-climb of four or five hours' duration. Associa-

[1] *English Men of Science*, p. 172.
[2] Francis Galton, *op. cit.*, p. 58.

tions will not respond under the influence of fatigue that comes over an amateur who must break in his climbing-muscles each summer. Mosso quotes alpinists as saying that the events of the last part of an ascent are least distinctly remembered, and one "was obliged to take notes during an ascent, because on his return in the evening he remembered almost nothing." This probably refers to a condition of complete exhaustion. At any rate the writer has not observed it in himself, not even after a severe six hours' ascent of Long's Peak. Memory was not normal, but its deficiency lay rather in failure to recall the details of what had been read or heard previous to making the ascent.

The effect of fatigue upon memory raises the larger question of the relation between different sorts of fatigue. The belief is quite general that, when one is mentally tired, change of occupation gives sufficient rest. This is probably true only when fatigue is not fatigue, but *ennui*. Work becomes monotonous and we think that we are tired. Indolence is often taken for fatigue. In such cases change of occupation is refreshing. Even another book treating of a different subject brightens the mind. Mere change, with its new sights, and sounds, and people, breaks the dead level of monotony. One grows tired of seeing the same persons and hearing them say the same things. So one finds that "fatigue" vanishes in another town or city, though the conditions for work may be no better in other respects. For this reason it is mental economy occasionally to pack one's grip and begin anew in another place. Change of scenery clears the mind. The writer invariably finds that the "fatigue" of the year disappears and that work can be continued with renewed vigor when vacation permits a change of habitat. Sometimes, again, one has sat so long that the muscles are tired. Exercise or a brisk walk in the open is then a relief. Moderate muscular exercise is also stimulating. The abundant oxygen of the fresher air also plays its part.

The work-cure for those with whom fatigue is chronic is closely related to this matter of change. The "invalid" who waits till he feels able to work will never begin. The writer has known of young women afflicted with chronic invalidism who were cured by activity. In several cases it was social-settlement work, in which they were so busy and stood on their feet so long that strong men would have been exhausted. Yet at night they were only pleasantly tired. One young woman who could not walk half a mile without exhaustion and whom the slightest exertion sent to bed, became so interested in a secretaryship which she secured that the day's work brought no fatigue, though typewriting is not a restful occupation. A part of the value of the "work-cure" consists, of course, in keeping the thoughts from one's "afflictions" and in dissipating worry; and worry is the most efficient promoter of fatigue. Work or activity of any sort, in which one finds pleasure and success, is almost certain to be unattended by fatigue. The usual periods of rest and vacation will be sufficient to meet the demands for recuperation.

But none of these states is fatigue in the proper sense. When one is tired from concentrated attention and thought, change of occupation is likely to augment fatigue. Intellectual activity, to be worth while, should be intense. Nerve-centres are then exhausted, and for this reason the muscles themselves are weakened. Maggiora tested the endurance of the middle finger of his left hand in Mosso's laboratory. In the morning tests his finger contracted fifty-three times before temporary exhaustion. In the afternoon he examined twelve students—candidates for the doctor's degree—during three and one-half hours. Then he again tested the endurance of his finger and found that it was exhausted by twelve contractions. Even after two hours of complete repose it had not regained its strength of the morning. A tired brain evidently means a tired body.

This relation between brain and body in the matter of

fatigue is especially important in connection with school work. First of all, it should be said that children rarely study hard enough to become fatigued. With them what is called fatigue is more commonly languor arising from lack of interest—or it is the outgrowth of nervous excitement resulting from the confusion of commands and prohibitions. At home and in school, at different times, children are forbidden and permitted to do the same thing, according to the momentary mood of those over them, until rules of action become chaotic. Again, "dangerous fatigue is the result of unhealthy confinement within doors, or is owing to unwholesome shocks, and puzzlings, and confusions, and conflicts of impulses resulting from the imposition of scatter-brain notions of teaching and discipline, imposed much too fast for the child to grow to, or even to comprehend. . . . Other sources of dangerous fatigue are overstimulated ambitions or disproportionate pressure and rivalries, instigated by home or class companions." [1]

The "dangerous fatigue" from unhealthy confinement within doors, to which reference has just been made, is worth a moment's digression. One of the problems of fatigue is how to escape it without unnecessary reduction of work, and for children, at least, the open-air schools seem to have given the solution. They remove the fatigue-limit to the evening and night, where it belongs. "Observations have shown that the pupils in outdoor and open-window schools are not only kept more healthy, but learn more quickly than those in the ordinary school"; [2] and their work is also more accurate.[3] Recent investigation[4]

[1] Smith Baker, *Educational Review*, vol. 15, pp. 35 *f.*

[2] *How to Live*, by Irving Fisher and Eugene L. Fisk, p. 19.

[3] Walter W. Roach, *American Journal of Public Health*, vol. 3, no. 2.

[4] *Report of the New York State Commission on Ventilation*, by E. L. Thorndike, W. A. McCall, and J. C. Chapman. Teachers College, Columbia University, *Contributions to Education*, no. 78. *Open-Air Schools*, Bulletin no. 23, Bureau of Education, Washington, 1917.

indicates that the harmfulness of confined and respired air is not due so much to its chemical components as to its physical features. Confined air is too warm, too dry, and too still. But whether the effect of confined air is due to its physical or chemical condition, there is no doubt of its influence in producing the feelings of fatigue, if not fatigue itself; and the greater wear and tear of work done under unfavorable atmospheric conditions promotes derangement of nervous functions and deterioration of tissues.

Let us turn now to one or two of the latest investigations of fatigue in school children. The most recent extensive test was made by Heck.[1] This investigation is of unusual significance because of the large number and variety of children included, and because of the natural conditions under which the tests were given. Over 1,100 children in four New York City schools, "representing different nationalities and different grades of social and hygienic opportunities" were tested under the usual schoolroom organization. The work was given at different times of the day—shortly after nine and eleven o'clock in the morning, and at one o'clock and half after two in the afternoon. The material was a modified form of one of Courtis' Standard Tests in arithmetic. The results showed that "mental fatigue in relation to the daily school programme is far less than generally believed. . . . The small amount of fatigue noticeable during the school-day was more probably caused by improper conditions of ventilation, lighting, etc., than by the school work itself. Unhygienic conditions in the school and physical defects, however slight, in the children are undoubtedly the great causes of fatigue in most schools. The decrease in quality of work of children as the day advances, supposed to be more or less general in schools, is due less to exhaustion of the energy-producing material of the nerve-cells of the body, and to autopoisoning of the nervous system by

[1] W. H. Heck, *Mental Fatigue in Relation to the Daily School Program*, 1913.

waste products from this process, than to a loss of interest in school work, with its lack of vital and varied appeal, and its monotony of instruction and environment. The bored child, unconsciously or consciously, rebels and does a less correct amount of work. Continued work produces boredom and continued boredom decreases efficiency, on account of the close mutual relation between physiological and mental attitudes. With sound bodies, a hygienic school, proper classification, frequent relaxation, a vital and varied curriculum, and live teachers, most children will show no problem of fatigue in relation to the daily school programme."

Heck also tested 573 children in the Lynchburg, Virginia, schools.[1] As before, two periods were taken in the morning and two in the afternoon. The length of the test was increased from ten to twenty-five minutes to determine whether a longer period would reveal fatigue. The results strengthened the former conclusions.

Still another test was made by Heck,[2] this time with 467 boys and girls in the Roanoke, Virginia, schools. "The final conclusion to be drawn from this experiment in Roanoke with reasoning-tests in arithmetic, as well as from those in Lynchburg and New York with the fundamental operations, is that normal, healthy children in the grammar grades, in a hygienic school environment, can meet the requirements of the usual daily school programme without injury to themselves or their work."

Short tests of ten minutes and also those involving continuous effort extending through an hour or more have been made recently in the grades of the Winthrop Training School.[3] The short tests consisted of examples in addition and subtraction, while the longer ones were drawn from algebra, history, and Latin. The results indicate that "in

[1] *Psychological Clinic*, vol. 7, p. 29.
[2] *Op. cit.*, vol. 7, p. 258.
[3] L. A. Robinson, *Bulletin no. 2, Winthrop Normal and Industrial College.*

general there is more *weariness* than fatigue in the children; and mental activities are more necessary than complete idleness. Here, then, is the teacher's problem: How to provide the proper mental stimulations for keeping up the interest in school. . . . If a boy sees no purpose in learning he will not learn."

"A fair claim to make on the basis of the results obtained," says Thorndike,[1] in summing up his investigation of fatigue in school children, "is that a regular day's work in the grammar school does not decrease the ability of the child to do mental work. . . . The chief responsibility for mental exhaustion in scholars falls, I should be inclined to think, not on a Creator who made our minds so that work hurts them, nor on the public opinion which demands that children shall do a given amount of work, but upon the unwise choice of material for study, the unwise direction of effort, the unwise inhibition of pleasurable activities, the unwise abuse of sense-organs, and unattractiveness of teachers and teaching."

We have quoted from these experiments in some detail because the information is needed as an antidote to the sentimentality regarding fatigue. Maudlin emotions threaten to deprive children of the advantages of a busy, thoughtful life during a small part of the day. As a matter of fact, if children are as fresh after two hours in school as when they entered, they have missed something worth while. Moderate fatigue, if caused by work and not by foul air or nervous irritation, is not bad, provided school is forgotten on the playground and sleep is abundant and undisturbed. Probably one of the chief causes of injurious fatigue in children is the constant nagging to which they are so commonly subjected. A shrill, penetrating voice, exploding with "don'ts," has little efficiency beyond nervous irritation.

Experiments on fatigue presuppose that it will always

[1] *Psychological Review*, vol. 7, p. 547.

reveal itself in the quantity or quality of work accomplished. Yet there are two physiological facts which seem to deny this assumption. And this contribution from physiology has not received sufficient attention from investigators of mental fatigue. The first of these two facts is the stimulating effect of small quantities of fatigue-substances.

"If present in small quantity, or moderate quantity, for a brief time, each substance," says Lee, "causes an augmentation of activity of the muscle, which is characterized by an increase in irritability and working power, an increase in the height to which the load is lifted, and an increase in the total amount of work performed." [1] And again, as Bayliss says: "It appears that the presence of a small quantity of products of activity is favorable." [2] This has been demonstrated only for muscle, but the assumption that it is also true of mental activity is a possibility which cannot, at any rate, be denied. If this stimulating effect of a moderate amount of fatigue-substances shall be found true also of mental activity, we may then expect, for a brief time, an improvement in the quantity and quality of work; and one investigator[3] thinks that there is such a period when fatigue acts as a stimulant in mental as well as in muscular work.

Let us now turn to the second physiological fact to which reference has been made. Gruber[4] fatigued a muscle with an hour's work and then allowed it to rest for an hour and a half. The result of this rest was a gradual but steady recovery of vigor. Then adrenalin was injected, and the effect, five minutes after the injection, was a further, but at the same time abrupt, recovery of 61 per cent. Subsequent rest for an hour and a half produced no further recovery. In another experiment the effect of

[1] *American Journal of Physiology*, vol. 20, p. 170, and *Columbia University Studies in Psychology*, reprints, 1907–1909.

[2] *Op. cit.*, p. 451.

[3] May Smith, *British Journal of Psychology*, vol. 8, p. 327.

[4] Charles M. Gruber, *American Journal of Physiology*, vol. 33, p. 335.

adrenalin, after an hour's work, was substantially the same, showing a recovery of 62 per cent. Gruber proved that the effect of adrenalin is a counteraction of fatigue by determining the threshold stimulus for muscle and nerve-muscle in non-fatigued animals before and after injecting adrenalin. He found that in the case of non-fatigued muscle there was no lowering of the threshold, "a result in marked contrast with the pronounced and prompt lowering in fatigued muscle by this agent."

"It is quite conclusive," says Gruber, "that adrenalin, in some way, causes a rapid recovery of normal irritability of muscle after fatigue. The question whether this is done by neutralizing, transforming, or destroying the fatigue toxins is still obscure. That the action may be on the muscle itself has been definitely shown in this" [Gruber's] "paper; its effect, however, upon the nervous elements or on the region of the neuromuscular union cannot be denied. . . . Adrenalin acts quickly, requiring five minutes or less to produce its effect on the threshold" [of fatigue]. "In that length of time, in some cases, it reduces the threshold to normal, whereas rest would require fifteen minutes to two hours." [1]

The experiments just quoted show that adrenalin injected into fatigued muscle has a remarkable recuperative effect. The inquiry arises at once then, Is there any arrangement in the body by which adrenalin is supplied and made to serve the same purpose during life? Experiments have answered this question in the affirmative. The suprarenal capsules are glands, situated above the kidneys, which secrete a substance, to which the name adrenalin has been given. This secretion passes into the blood. Investigations[2] have demonstrated that artificial

[1] *Op. cit.*, p. 354.

[2] T. R. Elliott, *Journal of Physiology*, vol. 44, p. 400; Otto Folin, W. B. Cannon, and W. Denis, *Journal of Biological Chemistry*, vol. 13, p. 477; W. B. Cannon and Henry Lyman, *American Journal of Physiology*, vol. 31, p. 376.

stimulation of the splanchnic nerves increases this secretory activity, and as a result the adrenalin in the blood is increased. Here, then, is a mechanism by which the adrenal glands can be made to discharge their secretion into the blood.

Several years ago, it was observed[1] that, with artificial stimulation of the splanchnic nerve, a muscle did "for a short period 80 per cent more work than before splanchnic stimulation, and for a considerably longer period exhibited an intermediate betterment of its efficiency." At that time a considerable part of this improvement was ascribed to the increased blood-flow resulting from splanchnic stimulation. The investigators raised the question, however, as to whether this explanation was sufficient. Later investigation[2] verified this effect of increased blood-flow through excitation of the splanchnic nerve, but it proved, in addition, that the recovery of muscle and its strengthened action was due in part to a specific action of adrenalin itself. Splanchnic stimulation is thus seen to promote recovery of muscle from fatigue and increase its action in two ways, first, by increasing the arterial blood-pressure and so cleansing the working muscles with fresh blood, and second, by liberating adrenalin, which acts specifically upon muscles, restoring their working power.

How, then, does this work out in life? It is clear, as Cannon has indicated,[3] that increased arterial pressure would be highly serviceable to animals in times of stress. It would clear away the waste and fatigue products. Now adrenalin, secreted by the adrenal glands and passed into the blood, does this and more. "The heart, the lungs, and the brain, as well as the skeletal muscles, are in times of

[1] W. B. Cannon and L. B. Nice, *American Journal of Physiology*, vol. 32, p. 44.

[2] Charles M. Gruber, *American Journal of Physiology*, vol. 32, p. 221, vol. 33, p. 335, and vol. 34, p. 89.

[3] Walter B. Cannon, *Bodily Changes in Pain, Hunger, Fear, and Rage*, 1915, pp. 132 *ff.*

excitement abundantly supplied with blood taken from organs of less importance in critical moments." It also tones up the muscles that have become fatigued through continued activity. Emotional excitement, of course, always accompanies stress and danger. Consequently, the relation of excitement to adrenal secretion is important.

Adrenal secretion is known to be increased during strong emotions. This has clearly been demonstrated in a cat placed near a barking dog, and Elliott[1] observed that no greater excitement is needed in animals than the strangeness of new quarters to induce a greater discharge of adrenalin into the blood.

Have we not here, then, a possible explanation for the failure to observe fatigue in school children? The youngsters know that they are to be tested for something. The conditions of class routine are changed. Perhaps a stranger comes into the school to give the tests. The situation is surely as "exciting" as the new quarters for the animals that Elliott tested. One who has given unusual tests of any sort knows well how alert and animated the children become. It is also a matter of common experience that the fatigue of adults often vanishes in even mild excitement. We know that under excitement the adrenal glands secrete and as a result physical fatigue disappears. To be sure, this has been proven only for muscular fatigue, but as Gruber has said: "Its effect upon nervous elements . . . cannot be denied." If the blood circulation of the brain is controlled by the autonomic system, and there is some evidence for this, then the tonic effect of adrenalin, already demonstrated in muscular fatigue, is also operative in mental activity. Further, there is no doubt that the increased arterial pressure flushes the nerve-cells of the higher centres as well as the muscular tissue, removing the fatigue products, and this is itself invigorating.

[1] T. R. Elliott, *Journal of Physiology*, vol. 44, p. 409.

There are, then, two physiological reasons why fatigue in its early stages may not be discovered by the tests usually given; the first is that fatigue substances in small quantities are stimulating, and the second is that adrenalin secreted under excitement and passed into the blood dissipates fatigue by increasing arterial pressure and by acting directly upon muscles, and perhaps upon nervous elements. Thus the condition that is sought disappears by reason of its very presence or because of the animation aroused by the attempts to find it. One may seriously doubt, however, whether fatigue is present in many cases. Children fortunately are endowed with an indifference to the demands of their teachers. If they did all that they are told to do and did it as well as they are told they should, every school must needs be equipped with an adrenalin laboratory—like Weichardt's antifatigue-toxin factory. Happily, native indolence comes to the aid of children, and they refuse to be overworked. Undoubtedly, they could do much more without fatigue than they actually accomplish if the things at which they are set appealed to them as worth while. Subjects of study should not be made easy, but their value and significance should be evident to those working in them. And, after all, this is a very human demand.

As one looks through the voluminous literature on fatigue[1] one is impressed by the fact that "fatigue," as ordinarily investigated and measured, is exceedingly complex and that many times it is not fatigue that is tested but inattention and the inability to ignore sensations, feelings, and thoughts of one sort or another which have no definite relation to fatigue. Sleepiness, discomfort from the hard, straight-backed chair, temporary *ennui* for the

[1] The investigations are too numerous to cite, but excellent bibliographies are given by C. S. Yoakum in *Psychological Review Monograph Supplement*, no. 46, 1909, and by F. C. Dockeray in the *Kansas University Science Bulletin*, vol. 9, 1915.

task in hand, and staleness on account of the *ennui*, as well as thoughts of pleasanter activities, are a few illustrations from the many that might be mentioned. "I was constantly surprised," says Thorndike,[1] in his analysis of this condition, "to find myself when feeling, as I would certainly have said, 'mentally tired,' unable to demonstrate in the feeling anything more than emotional repugnance to the idea of doing mental work. On at least half the occasions this seemed to be all there was."

The feeling of lassitude, again, is quite commonly the result of lack of physical exercise. It has been observed that adults who engage in vigorous out-of-door work or sports, without overdoing, require less sleep and accomplish more mental work without fatigue. The sensations of strain and the feeling of effort may be due, also, to the disagreeable monotony of the task. As a relief from *ennui*, mere change is recuperative, and this is probably another reason why experiments and tests so frequently reveal little fatigue. The student may be weary from his previous work, but not fatigued.

Curves showing the progress of work, aside from the practice effect, are curves of a good many more things than fatigue. Pleasure and displeasure are important factors in postponing or hastening fatigue. Wright noticed[2] in his investigations that "the fatigue accompanying work is not so great when the person is working under the direct stimulus of a definite aim, notwithstanding the fact that he has at the same time produced an increase in the amount of work." The aim gives point and zest to what would otherwise be a disagreeable task, and it prevents the sensations, feelings, and thoughts mentioned above from arising in the mind. This is always the effect of a purpose in which one is interested. Aimless work is soon reduced to drudgery, and few activities are more fatiguing. The more

[1] *Psychological Review*, vol. 7, p. 547.
[2] W. R. Wright, *Psychological Review*, vol. 13, p. 23.

immediate and direct the aim and the more it concerns the present interests of the worker, the less likely is the mental condition commonly regarded as fatigue to appear. Since we may suppose that toxic products are always produced by continuous physical or mental activity, the difference in the effect of pleasant and dreary work would seem to lie in the rapidity with which they are disposed of or eliminated. It is not unlikely that the freer blood-circulation and the buoyant feeling attending the exhilaration of pleasure carries away these toxic products more rapidly than in the more sluggish condition of *ennui*. At all events, it is clear that disagreeable, monotonous work fatigues and wears one out more quickly than pleasant occupations. Perhaps this is one reason for the prodigious and at the same time unimpairing work of von Humboldt, Mommsen, and Edison. Such men are fortunate enough to have found work in which they could engage with unmitigated joy.

CHAPTER VI

CURIOSITIES OF MEMORY

Not long ago one of our leading monthly magazines exhibited a tragic scene. A man with wild despair pictured in his face was tearing his dishevelled hair in a most indiscreet manner, and under the picture were emblazoned the portentous words, "I forgot." The advertisement then went on to inform the readers where they might purchase a memory system with which they could remember five thousand facts.

The success of such advertisements in selling the lessons indicates that remembering is, to a large extent, a "lost art," and that people commonly regard information as the most important factor in memory and intelligence. But what should we do with five thousand isolated facts if we had them? We all have many more now than we are able to use.

The first problem in connection with memory, therefore, is to learn how to make use of facts. Memory of so much information as can be used will then take care of itself, for facts that are applied are retained. Information is of value only to the extent to which it enters into one's thinking. It is the raw material out of which thoughts are made. But thinking, we have seen, is not a mechanical process. It does not come from merely piling up facts. Not even when the facts are put together in some sort of order, after the manner of the bricks that make a house, does thinking occur. An artistic arrangement of facts may produce day-dreams, but thinking is directed toward a definite end, like solving a problem or reaching a conclusion.

At its lowest terms thinking requires selection of mate-

rial with reference to its service in promoting a reasonable conclusion. Mere facts have no significance. Only as they have meaning in relation to other facts do they gain importance. Evidently, then, understanding an event requires for its interpretation the aid of all available information. In this way facts acquire meaning and the significance of the event is understood. This, of course, frequently calls for extensive knowledge and seems to imply that everything which one finds in the course of one's study and reading should be remembered. This is not true, however, as we shall see if we go a little further. The use of the material of knowledge and its accurate recall are two very different matters. One may, for example, remember the conclusion reached without recalling all the details leading to the conclusion. "Intuitions" are another illustration. To a large extent they are the residua of experiences which were not, and perhaps could not be, analyzed. They are the "impressions" left in memory, but not recognized as facts of personal experiences. Their source is much the same sort of submerged memories as some of the more spectacular instances to which reference will be made in this chapter. Again, selection of material is always for a definite purpose. Consequently, only certain facts from among those actually conserved in memory are desired at any given moment. But let us go a little further in our consideration of the use of memory.

Information from the standpoint of memory is of two kinds: That which we need so constantly that it must be kept "in mind," and that which we may look up as occasion arises. Some things should not be remembered. Efficiency requires, among other things, that the mind be not overloaded. It is as important to forget as to remember. But we must forget the right things. Here is where selection begins. A lawyer should remember the trend of important court decisions, but when he needs the details

he knows where to find them. What one should remember is a matter of judgment. The important thing, however, is that this selection be a thoughtful act and not left to chance, as is so frequently the case.

Interest is usually said to be the determining factor in deciding what one shall remember. This interest may be racial—spontaneous, or involuntary. A boy can tell you at once the record of national baseball-clubs and the batting average of the individual players. Again, this interest may be acquired from the necessities of a situation. The writer once watched a young negro take the hats of over two hundred strangers as they entered the dining-room of a large hotel. So far as could be observed no system was followed in arranging the hats on the rack. Indeed, a system itself would have been an exceedingly difficult feat of memory, since the guests did not come out in the order in which they entered, and only a few of the dining-tables could be seen by the attendant. Yet he did not make a single mistake in distributing the hats. As soon as he saw a man approaching he went at once to the rack and got the right hat.

Many facts, however, indicate that interest is only a partial explanation. It is clear that many more experiences are conserved than come into conscious memory under any circumstances of normal, every-day life. Sometimes these conserved experiences affect our behavior without our being aware either of the experiences or of their influence. We do not recall the events. Even when we do they may not be connected in our minds as causal factors of our actions. The purpose in the present chapter is, first, to describe briefly a few of these singular phenomena of memory, and, second, to show that these conserved experiences, even though we are not conscious of them, may profoundly affect our thinking and acting.

Helen Keller has reported[1] an incident in her life which

[1] *The Story of My Life*, pp. 63–69.

shows the indelible record that experience may write upon the mind and its irresistible though unconscious influence. At about the age of twelve Miss Keller wrote a little story which she called *Autumn Leaves*. "I thought then," she says, "that I was 'making up a story,' as children say, and I eagerly sat down to write it before the ideas should slip from me. My thoughts flowed easily; I felt a sense of joy in the composition. Words and images came tripping to my finger ends, and as I thought out sentence after sentence I wrote them on my Braille slate. . . .

"When the story was finished I read it to my teacher, and I recall now vividly the pleasure I felt in the more beautiful passages, and my annoyance at being interrupted to have the pronunciation corrected. At dinner it was read to the assembled family, who were surprised that I could write so well. Some one asked me if I had read it in a book.

"The question surprised me very much, for I had not the faintest recollection of having had it read to me. I spoke up and said: 'Oh, no, it is my story, and I have written it for Mr. Anagnos.'

"Accordingly, I copied the story and sent it to him for his birthday. It was suggested that I should change the title from *Autumn Leaves* to *The Frost King*, which I did. I carried the little story to the post-office myself, feeling as if I were walking on air. . . .

"Mr. Anagnos was delighted with *The Frost King*, and published it in one of the Perkins Institution reports. . . . I had been in Boston only a short time when it was discovered that a story similar to *The Frost King*, called *The Frost Fairies*, by Miss Margaret T. Canby, had appeared before I was born in a book called *Birdie and His Friends*. The two stories were so much alike in thought and language that it was evident Miss Canby's story had been read to me, and that mine was—a plagiarism. It was difficult to make me understand this; but when I did

understand I was astonished and grieved. No child ever drank deeper of the cup of bitterness than I did. I had disgraced myself; I had brought suspicion upon those I loved best. And yet, how could it possibly have happened? I racked my brain until I was weary to recall anything about the frost that I had read before I wrote *The Frost King;* but I could remember nothing except the common reference to Jack Frost and a poem for children, *The Freaks of the Frost,* and I knew I had not used that in my composition. . . .

"Miss Sullivan[1] had never heard of *The Frost Fairies* or of the book in which it was published. With the assistance of Doctor Alexander Graham Bell she investigated the matter carefully, and at last it came out that Mrs. Sophia C. Hopkins had a copy of Miss Canby's *Birdie and His Friends* in 1888, the year that we spent the summer with her at Brewster. Mrs. Hopkins was unable to find her copy, but she has told me that at that time, while Miss Sullivan was away on a vacation, she had tried to amuse me by reading from various books, and although she could not remember reading *The Frost Fairies* any more than I, yet she felt sure that *Birdie and His Friends* was one of them.

"The stories had little or no meaning for me then, but the mere spelling of the strange words was sufficient to amuse a little child who could do almost nothing to amuse herself; and although I do not recall a single circumstance connected with the reading of the stories, yet I cannot help thinking that I made a great effort to remember the words, with the intention of having my teacher explain them when she returned. One thing is certain, the language was ineffaceably stamped upon my brain, though for a long time no one knew it, least of all myself. . . .

"I have read *The Frost Fairies* since, also the letters I wrote in which I used other ideas of Miss Canby's. I find

[1] Miss Keller's teacher.

in one of them, a letter to Mr. Anagnos, dated September 29, 1891, words and sentiments exactly like those of the book. At the time, I was writing *The Frost King*, and this letter, like many others, contains phrases which show that my mind was saturated with the story."

Evidently, the mind absorbs vastly more from reading and conversation than has been supposed. Miss Keller's experience reveals undreamed-of possibilities for indirect and incidental training of literary style and for imparting ideas and incentives to action. Past thoughts which return to mind—old friends yet unrecognized—exert a profound influence upon belief and conduct. This is one phase of what is called experience. We grow unconsciously into opinions, the source of which we are often unable to discover. But, while "forgotten" experiences at times play a leading rôle in mental development, there is a good deal of evidence to show that the voluntary memory of most people is hardly one-half efficient.

Seneca is said to have been able to repeat in exact order 2,000 disconnected words which he had heard spoken but once; Cyrus and Cæsar knew the names of all the soldiers in their respective armies, and Themistocles could address by name 21,000 Athenian citizens. Probably these stories exaggerate the facts, as is usual after men have become famous, but at any rate they indicate that these men possessed remarkable memories. There were, of course, incentives which are, perhaps, not so strong to-day. The personal factor, doubtless, loomed larger than in this day of long-distance connections. Nevertheless, the memorial achievements of these men, even after the proper discount has been made, was probably exceptional, and they reveal possibilities which may be approximated if not fully attained.

The statement is sometimes made that no experience is irretrievably lost, that everything which one hears or sees is conserved as potential memories. This is probably not

true, yet remarkable instances are cited which indicate that very much more is conserved than is commonly supposed. Coleridge has related a case which, if correctly reported, is one of the most remarkable of which we have any knowledge.

A year or two before Coleridge's arrival at Göttingen something happened which "had not then ceased to be a frequent subject of conversation" in the town. "A young woman of four or five and twenty, who could neither read nor write, was seized with a nervous fever, during which, according to the statements of all the priests and monks of the neighborhood, she became possessed, and, as it appeared, by a very learned devil. She continued incessantly talking Latin, Greek, and Hebrew, in very pompous tones and with most distinct enunciation. . . . The case had attracted the particular attention of a young physician, and by his statement many eminent physiologists and psychologists had visited the town and cross-examined the" [persons] "on the spot. Sheets full of her ravings were taken down from her own mouth, and were found to consist of sentences, coherent and intelligible each for itself, but with little or no connection with each other. Of the Hebrew, a small portion only could be traced to the Bible; the remainder seemed to be in the Rabbinical dialect. All trick or conspiracy was out of the question. Not only had the young woman ever been a harmless, simple creature, but she was evidently laboring under a nervous fever. . . . The young physician determined to trace her past life step by step. . . . He, at length, succeeded in discovering the place where her parents had lived . . . and" [learned from an uncle] "that the patient had been charitably taken by an old Protestant pastor at nine years" [of age], "and had remained with him some years. . . . Anxious inquiries were then, of course, made concerning the pastor's habits; and the solution of the phenomenon was soon obtained. For it appeared that

it had been the old man's custom for years to walk up and down a passage of his house into which the kitchen-door opened, and to read to himself with a loud voice out of his favorite books. . . . Among the books were found a collection of Rabbinical writings, together with several of the Greek and Latin fathers; and the physician succeeded in identifying so many passages with those taken down at the young woman's bedside, that no doubt could remain in any rational mind concerning the true origin of the impressions made on her nervous system."[1] One of the amazing features of this case, if correctly reported, is that the woman could not have understood any of the sentences which she heard and afterward, according to Coleridge, repeated.

Under certain unusual conditions a flood of "forgotten" memories may sweep through our mind. Apparently a channel must be cut into the series of submerged experiences to give the flow an outlet. Then some connection with the present mental content is needed. As we shall soon see, the channels are nervous paths. Analogies are always imperfect, but the facts seem to justify some such description of the process. Sometimes no reason for the stupendous burst of memories can be discovered beyond the impressiveness of the moment. At such times no cause can be assigned except the favorable mental attitude.

When one is drowning, for example, the events of one's past life sometimes rush with incredible swiftness and accuracy through the mind. Many of these details have not been recalled for years, and some of them have been long forgotten, in the ordinary acceptance of the word. Such an experience of Rear-Admiral Sir Francis Beauford is related by Harriet Martineau. During the brief period in which he was sinking for the third time it seemed as if every event of his past life was reviewed. "The course of those thoughts I can even now in a great measure retrace," he

[1] *Bibliographia Literaria*, New York, 1847, vol. I, pp. 234–235.

told Miss Martineau. "The event which had just taken place; the awkwardness which had produced it; the bustle it must have occasioned; the effect it would have on a most affectionate father; the manner in which he would disclose it to the rest of the family, and a thousand other circumstances minutely associated with home, were the first series of reflections that occurred. Then they took a wider range: our last cruise; a former voyage and shipwreck; my school, the progress I had made there, and the time I had misspent, and even all my boyish pursuits and adventures. Thus travelling backward, every past incident of my life seemed to glance across my recollection in retrograde succession; not, however, in mere outline, as here stated, but the picture filled up with every minute and collateral feature. In short, the whole period of my existence seemed to be placed before me in a kind of panoramic review, and each act of it seemed to be accompanied by a consciousness of right or wrong, or by some reflection on its cause or its consequences; indeed, many trifling events which had been long forgotten then crowded into my imagination, and with the character of recent familiarity."[1]

Admiral Beauford was convinced that this extensive and detailed review lasted only during submersion. In that case it was completed in about two minutes. If it continued until he was restored to consciousness it lasted twenty minutes. It will be observed that something more than a biographical review was given. There were filial and moral reflections. In some ways it is a striking picture of the mind at its best, judging motives, cause and effect, and untrammelled by the restraints and inhibitions of normal, conscious thinking.

There are other ways, however, in which "lost" memories may disclose themselves. Not infrequently those accustomed to follow trails through dense woods are unable

[1] *Biographical Sketches*, London, 1870, pp. 219 *f.*

to recall the paths or direction that they took to reach their destination. Yet, several years later, when they again set out upon the same trip, the journey is a continuous succession of familiar objects and vistas. Here half a dozen trails cross; but a stone or tree, or some other familiar object, indicates the route, though so far as the traveller is aware he gave no unusual attention to these landmarks when he first took the trip. But more striking instances are sometimes observed.

William B. Carpenter has given an interesting case which shows how experiences of childhood may be impressed and conserved though the "memory" reveals nothing of them. Later, when a part of the same childhood's experience is again witnessed, the entire scene, in all its details, is reproduced as a vision.

"Several years ago," says Carpenter, "the Reverend S. Hansard, now rector of Bethnal Green, was doing clerical duty for a time at Hurstmonceaux, in Sussex; and while there he one day went over with a party of friends to Pevensey Castle, which he did not remember ever to have previously visited. As he approached the gateway he became conscious of a very vivid impression of having seen it before; and he 'seemed to himself to see' not only the gateway itself but donkeys beneath the arch, and people on the top of it. His conviction that he must have visited the castle on some former occasion—although he had neither the slightest remembrance of such a visit nor any knowledge of having been in the neighborhood before going to Hurstmonceaux—made him inquire from his mother whether she could throw any light on the matter. She at once informed him that, being in that part of the country when he was about *eighteen months* old, she had gone over with a large party, and had taken him in the pannier of a donkey;, that the elders of the party having brought lunch with them had eaten it on the roof of the gateway, where they would have been seen from below,

while he had been left on the ground with the attendants and donkeys." [1] Evidently, even at this early age, impressions were so deeply made as to be preserved through long years of forgetfulness; and when they reappeared they had no place in Mr. Hansard's experiences. They did not belong with his personal memories.

Some of these facts of memory seem incredible. Aside from the apparent accuracy of the reports, however, they are made plausible through the reproduction of forgotten events by automatic writing, crystal vision, and hypnosis. These latter cases reveal possibilities of conservation and reproduction of experiences hitherto hardly fancied even in the most reckless imaginative literature. We cite a few instances for illustration.

Doctor Morton Prince has described two experiments in crystal vision.[2] The subject was a young woman, who at the time was one of Doctor Prince's patients. A glass ball such as is commonly used not being at hand, an ordinary electric-light bulb, disconnected from the wires, was substituted. When Miss X, who had not been hypnotized, looked into the bulb, she saw and described a scene which had no place in her memory, and hence had no meaning to her. Under hypnosis she repeated the description of the occurrence, with the addition of further details, including its time and place. Afterward, on carefully going over the events of that period, she recalled the event. It was a trivial incident of too little importance for voluntary recall.

At another time,[3] disturbed because she had absent-mindedly torn up two ten-dollar bills and thrown the pieces away, she arose in her sleep, shortly after discovering her loss, and hid the remainder of her money under the table-cloth. She also placed two books, a red and a

[1] *Principles of Mental Physiology*, by William B. Carpenter, p. 431.
[2] "An Experimental Study of Vision," *Brain*, vol. 21, p. 528.
[3] *Ibid.*

green one, as she afterward found, over the place of its concealment. The next day, unable to find this money, she was greatly distressed, since it was all she had. She said nothing to Doctor Prince about her loss, but he meanwhile had learned of it while she was under the influence of hypnosis. Without disclosing his knowledge he handed her the electric bulb—she was not hypnotized at the time—told her to look into it, think of her money, and she would learn what had become of it. "She looked into the globe and saw herself in bed in her room. She then saw herself get up, her eyes being closed, and walk up and down the room; then she saw herself going to the bureau drawer, taking out her money, going to the table, taking up the table-cloth with the books, putting the money on the table, covering it with the cloth and putting the red book and the green book on the top of it. . . . Miss X reported on her next visit that she had found the money where she had seen it in the globe."

The glass ball used in such experiments is merely a device for stimulating suggestions that arouse associations which have not recently been active; perhaps, indeed, they have never acted in connection with the event that furnishes the motive for the effort to revive them. The glass ball also aids in concentrating attention and produces hallucinatory visions that start associative processes which may awaken forgotten memories. The writer hastens to add that there is not the slightest evidence for an occult explanation of crystal vision or of automatic writing.[1] These revived memories are memories of actual experiences—things that the person has done, heard, or seen—which have left their record in just the same way as do ordinary memories. The difference between the two lies in the difficulty of recall in the case of so-called "forgotten" memories. For this reason artificial means of stimulating

[1] For the latest investigation of several of the "occult" phenomena, see *Psychical Research Monographs*, vol. 1, Stanford University, 1917.

revival must be employed, and a crystal or electric-light bulb serves this purpose.

Let us now turn to another sort of device for recovering lost memories. A few years ago Mrs. A. W. Verrall, a teacher of Latin and Greek in England, became interested in automatic writing and, after repeated failures, acquired considerable proficiency. In her published experiments,[1] Latin, Greek, and English were at times mixed, as might be expected of an Englishwoman fairly conversant with the ancient languages. Her automatic composition is replete with selections which she had "forgotten." These quotations are not always strictly accurate, and here again the resemblance to the defects of ordinary memory is evident. Even when she was acquainted with the quotations they were rarely, if ever, those with which she was most familiar. "The Latin and the Greek of the script are," Mrs. Verrall says, "at once more fluent and more faulty than my own; the vocabulary is larger, embracing words unknown to me, though often tolerably obvious in meaning and correctly formed; the grammatical construction is less strict than in classical writers, and in the case of the Latin the whole turn of phraseology is often mediæval, or at least very 'late'; the mistakes are frequent, and often of a type quite unlikely to be made by myself; in fact, the suggestion, especially of the Latin, is that the language used is one in which the writer habitually expresses himself, and is certainly not the language of the classical writers known to me."

An interesting feature about some of Mrs. Verrall's automatic writing was that it wrote Greek and English verse; yet "I am no poet," she says, "and I have great difficulty in producing even a short set of verses in English." Again, some of her automatic script was replete with puns; but "I have hardly ever made a pun in my life," she continues.

[1] *Proceedings of the Society for Psychical Research*, vol. 20, 1906, especially pp. 276 *ff.*

"I do not easily see analogies between words, and I am seldom amused by comic puns. But it is otherwise with the automatic script. It is fond of punning, and especially of punning upon names."

Further, by the automatic device, Mrs. Verrall wrote stories and tales. One, she felt quite certain, was reminiscent of the first *Idyll of Theocritus*, which she had read twenty-five years before and had not seen since. Another tale, the *Garden of the Hesperides*, was due, as she was convinced, to another literary reminiscence not recognized till much later. Though she did not remember the references at the time, she afterward discovered in a roundabout way that she had read a book containing some of them a number of years before they were reproduced through automatic writing. Much of the material she was unable to account for at the time of the writing, but diligent search supplied the source in a number of these cases, and then she remembered having previously seen it.

The present writer admits quite freely that finding the data of the automatic productions, in tales and in other material which Mrs. Verrall had read years before, or upon which her eye had incidentally fallen, does not explain the phenomenon of automatic writing; but it brings it into line with other more common facts of memory, and then it becomes no more mysterious than ordinary retention, about which, to be sure, no one can pretend to very definite knowledge. It is well known, however, that our eye frequently runs over pages of a newspaper, and, though we read little or nothing, we may find months or years later that some of it, perhaps much, returns to memory with amazing fulness, if not with complete accuracy.

Mrs. Verrall's automatic Latin composition suggests two interesting observations. First, since her compositions were largely composed of selections long forgotten, lost memories were recovered; and, second, among these re-

vived memories were passages with a noticeable resemblance to mediæval Latin. As Mrs. Verrall was not accustomed to use these language forms and structures a new element other than memory seems to be introduced. The explanation, however, appears to be as follows: mediæval Latin has a larger vocabulary of abstract terms than has classical Latin, and many English abstract words came to us from the schoolmen through the medium of late mediæval Latin. It would therefore be quite natural for Mrs. Verrall's forgotten memories to be expressed in mediæval forms. A bit of evidence that this might be expected is found in the Latin expressions commonly used by college students. Early college Latin compositions are likely to be literal translations of English abstract words into the Latin from which they were derived and for this reason they resemble the mediæval rather than the classical. In other words, Mrs. Verrall's revived memories, without the restraint of conscious selection of words, took the line of least resistance—mediæval Latin, with which she was not wholly unacquainted.

There are also other ways in which forgotten experiences may be recovered. Mr. G. Lowes Dickinson has reported[1] an instructive case of recall through hypnotism. The subject, Miss C., "purported to meet a certain lady, Blanche Poynings, who lived in the time of Richard the Second. This lady was described as a friend of the Earl and Countess of Salisbury, and a great many details were given about these and other personages of the time, and about the manners and customs of that age. The personages referred to, the details given in connection with them, and especially the genealogical data, were found on examination to be correct, though many of them were such as apparently it would not have been easy to ascertain without considerable historical research. Miss C. had not studied the period, and could not recall reading any

[1] *Journal of the Society for Psychical Research*, vol. 12, 1905–1906, p. 287.

book bearing upon it other than a novel called *John Standish*, which has been examined and found not to contain the information she had given. Ultimately, however, the source on which she had unconsciously drawn was discovered through a planchette. Miss C., writing with the planchette, received communications purporting to come from Blanche Poynings, which finally, by a very circuitous route, and after much evasion, gave the name of a book by E. Holt, entitled *The Countess Maud*, as being the book in which she, Blanche, and the other people referred to would be found. Miss C. then remembered that there was such a book and that it had been read to her" [when she was eleven years old], "but she could not remember that it had anything to do with Blanche Poynings, or with the other characters as to whom she had given information. On examination, however, the book proved to contain all of the personages and facts she had given."

Much of the information which Miss C. gave was contained in the appendix. This was exceedingly dull. So it is highly improbable that she read it at eleven years of age or that her aunt should have read it to her. "It would seem, therefore, that a good deal of information must have been left in her mind while she was simply turning over the leaves in the process, which she now recalls, of coloring some of the illustrations."

Accurate observation, it is usually said, is the prerequisite for recall; but even observation, as we ordinarily use the word, does not seem to be always necessary for impressing and conserving facts and details. Doctor Morton Prince gives the following instance which he himself observed: "I asked B. C. A. (without warning and after having covered her eyes) to describe the dress of a friend who was present, and with whom she had been conversing for perhaps some twenty minutes. She was unable to do so beyond saying that he wore dark clothes. I then found that I myself was unable to give a more detailed descrip-

tion of his dress, although we had lunched and been together about two hours. B. C. A. was then asked to write a description automatically. Her hand wrote as follows (she was unaware that her hand was writing): 'He has on a dark greenish-gray suit, a stripe in it—a little rough stripe; black bow-cravat; shirt with three little stripes in it; black laced shoes, false teeth; one finger gone; three buttons on his coat.'

"The written description was absolutely correct. The stripes in the coat were almost invisible. I had not noticed his teeth or the loss of a finger, and had to count the buttons to make sure of their number, owing to their partial concealment by the folds of the unbuttoned coat. The shoe-strings, I am sure, under the conditions, would have escaped nearly every one's observation."[1]

Were it the intention of the author to write a "Wonder Book" on memory, cases such as have been given could be multiplied to fill a volume. The purpose thus far, however, has been to show the almost incredible extent to which one's experiences may be conserved. The instances which have been quoted are so amazing that the credulous are inclined to seek at once for an occult explanation. The release of submerged memories in such cases, however, is no more enigmatical than their recovery in less spectacular instances. It is not uncommon for the sight of a childhood acquaintance to bring to mind a succession of memories which have not been recalled for fifty years. Indeed, objects and persons wholly unconnected with the childhood events may accomplish this through a similarity so remote and obscure as to wholly elude discovery.

Another illustration of the renewal of associations long lost to voluntary control was recently related to the writer. A friend says that her brother spoke Spanish almost exclusively when a young child. Later in life he forgot the language so completely as to be unable to recall

[1] *The Unconscious*, pp. 53–54.

voluntarily more than a few isolated words. Yet, when sleeping, he frequently talked intelligibly and extensively in the language. If these less unusual instances do not explain the more spectacular, they at least bridge the illusory chasm between retention and recall of every-day life, and the sensational cases at which the uncritical, who are seeking supernatural causes, stand agape; and the exceptional manifestations are thus removed from the realm of the occult.

Let us now try to find an explanation for the loss of memories and their occasional recovery through the strange ways of crystal vision, automatic writing, and hypnotism. It should be emphasized, however, that our attempt must be speculative and can yield at best only a working hypothesis. All that we can hope to do is to get a picture of one of the possible explanations for these singular phenomena.

In searching for our explanation no argument is needed to show that ideas which have passed from mind return under suitable conditions. It is also clear that to be remembered, experiences must be registered in some way. This record must also be preserved and, finally, it must be possible to reproduce it. Recognition—the assurance that we have had the experience before—is not essential. This is necessary only when what is recalled is to be recognized as a phase of one's own past life. Psychological textbooks include recognition in their definition of memory, that a distinction may be made between it and imagination. Suppose, however, that you "recall" an event and are uncertain whether you actually experienced it, but later find that you did. Does the corroboration of its feeling of familiarity transform an imagined event into memory? Recall of events without the knowledge that they have been a part of one's own experience may occur in automatic writing, crystal vision, and in hypnosis. Recall, with or without recognition, however, depends upon

association. But ideas which have passed out of mind are not retained as ideas. Retention, nevertheless, implies something to be retained, and, since this something cannot be the ideas, thoughts, and feelings themselves, the questions at once arise: Where does retention take place, and what is it that is retained?

To understand this it must be remembered that every mental process is accompanied by a physiological process in the brain. When we have an experience of any sort a change is produced in the cerebral neurones. There are indications that one of these changes is of a chemical nature. Investigation has shown that "a resting nerve gives off a definite quantity of carbon dioxide," that "stimulation increases CO_2 production," and that "CO_2 production from the resting nerve proportionally decreases as irritability diminishes. These facts prove directly that the nerve continuously undergoes chemical changes and that nervous irritability is directly connected with a chemical phenomenon." [1]

In applying to memory the theory that mental processes are always accompanied by physiological processes, it should also be noted that neurones correlated, through activity, with past experiences are re-aroused by the excitation of associated nervous processes. Through this concomitant activity of mental and physiological processes, and by the correlation of sets of neurones through association, neurones become organized into functionally united systems. A functionally united system of neurones is a group which has been active during an experience, and which consequently conserves whatever record of the experience remains after it has passed. These systems of neurones are distinct from other groups only in the functional sense. The action and interaction among their cells is the physical basis and physiological accompaniment of the experience in which they originally participated. These

[1] Shiro Tashiro, *The American Journal of Physiology*, vol. 32, p. 107.

systems of neurones are not wholly independent of one another. If they were they could be made active only from within themselves. They are in physiological connection with one another, and this larger connection constitutes the unity of the mind—of the "self." It makes each thought and experience a personal matter—*i. e.*, my experience. The functional connection of these systems of neurones with one another, however, is not as intimate as their connections within themselves. Once a system is broken into by its associative connection with the processes of another system it yields a flood of memories. But the trouble is to break through the barrier. This is the problem of recall, and we see here that it is also the problem of association of ideas. These functionally united systems of neurones cannot always be aroused voluntarily. An artificial device, like crystal vision or hypnotism, is sometimes necessary.

Experiments in hypnotism seem to support the view that there are groups of functionally united neurones, since certain facts which cannot be recalled in one stage of hypnosis may be brought back in another stage. Recall, however, whether produced by hypnotism, crystal vision, automatic writing, or by voluntary effort, is always the outcome of associative processes. The problem, then, is to start the associations which will awaken the desired memories. The truth of this is frequently seen in daily life. The sight of so insignificant a thing as a pencil will suddenly call to mind where one laid some notes for which one has spent weeks hunting. This experience of breaking through obstructions is at times observed in the normal mental state when one tries to recover a line of thought. Not infrequently the writer is unable to recall such thoughts even with the aid of the notes made at the time. But once the cue is found, the thoughts follow, one after the other, with amazing accuracy and fulness. The mental attitude has much to do with success or failure. And this

attitude includes, among other things, the marginal as well as the focal nervous activity and thoughts.

Severe effort to recall by force of "will" is not always the best method. Not infrequently by relaxing the bodily muscles and fixing the attention upon an event connected with what he desired to recall and allowing associations free play, the writer has succeeded in recalling details which refused to yield to voluntary effort. The play of associations in this case is promoted by putting oneself in the place in which the event occurred, physically, if possible; if not, then through the imagination. The writer has recalled the place of mislaid monographs, and the authors of books from which citations had been made, by sitting at his desk, fixing his attention upon some phase of the subject, and giving free rein to the interaction of associations. Critical examination of any portion of the stream of memories that float through the mind at this time inhibits the flow.

This method of recall resembles a condition which Doctor Morton Prince calls "abstraction." By way of illustration he tells of a young woman, a university student, who had lost some money which she wished to recover. "In abstraction she remembered with great vividness every detail at the bank-teller's window, where she placed her gloves, purse, and umbrella, the checks, the money, etc.; then there came memories of seating herself at a table in the bank, of placing her umbrella here, her purse there, etc.; of writing a letter, and doing other things; of absent-mindedly forgetting her gloves and leaving them on the table; of going to a certain shop, where, after looking at various articles and thinking certain thoughts and making certain remarks, she finally made certain purchases, giving a certain piece of money and receiving the change in coin of certain denominations; of seeing in her purse the exact denominations of the coins which remained; then of going to another shop and similar

experiences. Then of numerous details which she had forgotten. . . . Through it all ran the successive fortunes of her purse until the moment came when, looking into it, she found one of the five-dollar gold pieces gone." [1]

Recall of forgotten details when under the influence of the conditions of the original experience has been noted by commentators on criminal jurisprudence. Gross, writing on the investigation of crime, says[2] that the best way to help a witness to remember accurately is to place him in the same circumstances as existed when he experienced the events. "We especially recommend this procedure in complicated transactions," he says, "when, for example, the order of events is important, or when there are several actors in the same, and the part played by each must be determined. . . . Following this course, we often obtain the most astonishing results; people who in the magistrate's chambers remember nothing, change completely when they find themselves on the spot; they recall first the accessory details and subsequently some most important facts."

We are now ready to answer the first of the two questions asked above, *i. e.*, Where does retention take place? The registration of ideas or experiences, and the conservation of these records occur in the neurones of the brain. Some change is produced in the nerve-cells as the result of their activity during an experience. A permanently altered nervous disposition is established. Quite likely, some change also takes place in the nerves themselves. At any rate, certain nervous pathways become more permeable because of the experience; and these changes, with the increased permeability, reduce the physiological resistance for nervous impulses. The tendency is, therefore, toward the re-arousal of the cerebral activity that occurred

[1] *The Unconscious*, pp. 25–26.

[2] *Criminal Investigation*, by Hans Gross, translated by J. and J. C. Adam, p. 76.

during the original experience when any of these neurones are excited through their associative connections. Retention is a property of neural tissue. It is the cortical law of habit.

In answer to the second question—What is retained?—several answers have been given. F. W. H. Myers[1] and his followers assume a sort of psychological repository—the subliminal mind—in which ideas and experiences are preserved in their original form, and from which they occasionally sally forth into the realm of consciousness. Myers' suggestive work at once became strikingly popular and started a host of unscientific writers along his trail. Unfortunately, however, these followers could not interpret Myers' blazes. The result was a repetition of his words, with little or no intelligible meaning. But, aside from the fact that a subliminal psychological storehouse does not tally with physiological data, memory is too extensive to be explained in this way. There would not be shelves enough to hold the countless number of ideas, and they would surely get mixed up while in cold storage.

The view which satisfies the psychological and physiological requirements is, as we have seen, based on changes in the neurones. Various theories[2] have been offered to account for the changes produced in the brain by experiences, and to define the residua left in the neurones after stimulation. For our purpose, however, it is sufficient to say that memory has a physiological basis, and is primarily dependent upon processes which go on in the cortex. This is a repetition in terms of memory of what has already been said of mental processes in general. One proof of this physical basis of memory is that injury of sensory or

[1] *Proceedings of the Society for Psychical Research*, vol. 4, p. 256; *Human Personality*, 1904.

[2] *Die Mneme*, 1911, by Richard Semon. *On Memory*, 1896, by Ewald Hering. *Upon the Inheritance of Acquired Characters*, by Eugenio Rignano, translated by B. C. H. Harvey. "Sur la Dynamique Chimique du Système Nerveux," by T. B. Robertson, *Archives de Physiologie*, vol. 6, p. 388.

association areas affects memories. Further evidence is furnished by temporary amnesia from a blow on the head, as in a football-game, and by cerebral localization. If the visual centre is injured visual memories are impaired or lost. Now let us see the bearing of these facts upon the second question, *i. e.*, What is retained as the basis of memory?

When the ideas which are to be recalled were first in the mind there was an accompanying and underlying neural activity. As a consequence of this activity some effect was produced upon the cerebral neurones. One of these effects is quite certainly the establishing of functional connections. Then, later, when the recall of the original idea is desired, these functional connections facilitate the passage of nervous impulses along the path traversed before. If recall is successful the same nerve-structures which participated in the original experience are again active, and the same mental processes that accompanied the original neural activity reoccur. The result of the change caused in neurones by an experience is, then, first, a disposition to react in the same way whenever these neurones are stimulated by associated nervous impulses, and, second, a tendency, when they do act again, to reproduce the same or similar mental content. In this way thoughts, ideas, and experiences are repeated as memories. Memory is thus the mental aspect of a habitual response of nerve-centres, a repetition of processes which were active in the original experience. The record of ideas and experiences which have passed from mind but may be recalled as memories is thus conserved as physiological, functional complexes. But why is the repetition of these physiological processes so often suppressed? Why do we forget?

We are accustomed to say that we forget the things to which we do not give attention, that the attention is selective, that it fastens upon certain impressions, and that what it ignores is forgotten; and there is undoubtedly

much truth in these statements. Al Jennings tells an amusing story that shows how he forced a district attorney and several others to fix their attention upon a wrong date, and in this way established an alibi for one of his crimes. He and his gang robbed a train on the 1st of October. On the morning of the 2d of October [the following day] he walked into the office of the district attorney, Mr. Pittman. I now quote from Mr. Jennings. "Pittman," he said, "I've been hearing a lot of fool talk about my robbing trains and going on the dodge. I'm tired of it. I intend to surrender, face the music, and clear myself. I've a few things to settle up first, then I'm coming in. This is October 1st; two weeks from to-day, October 15th, I'll return. Have your officers ready. And as I left his office I repeated:

"Make a note of it—this is October 1st, and I'm coming back on the 15th.

"According to expectation, Pittman was so excited at seeing me and hearing of my intentions that the date impressed itself on his mind only as an inconsequential detail. He never thought to look it up at the time, and when I had use for him it was fixed in his mind—wrong.

"Going to the saloon of Ike Renfrow, I got him to send for Bob Motley, the sheriff, my father, and my brother John. Motley was my friend; I knew he wouldn't arrest me without a warrant. To them I talked just as I had to Pittman, getting the false date—October 1st—into their minds. Every one was delighted, and no one thought to verify my statement of the date. This made a perfect alibi, for the robbery had occurred eighty miles away at noon of October 1st." [1]

Attention, however, frequently does not satisfy the requirements of an explanation for memory. The following from Arnold Bennett's *Old Wives' Tales* appeals to common experience. Sophia Scales, during her sojourn in Paris, gave painful attention to the bitter struggle for the

[1] *Beating Back*, by Al Jennings and Will Irwin, pp. 121 *f.*

privilege of living. Yet, as she was leaving, it was "astonishing with what liquid tenderness she turned and looked back on that hard, fighting, exhausting life in Paris. For, even if she had unconsciously liked it, she had never enjoyed it. She had always compared France disadvantageously with England, always resented the French temperament in business, always been convinced that 'you never knew where you were' with French trades-people. And now they flitted before her endowed with a wondrous charm; so polite in their lying, so eager to spare your feelings and to reassure you, so neat and prim. And the French shops, so exquisitely arranged! Even a butcher's shop in Paris was a pleasure to the eye, whereas the butcher's shop in Wedgwood Street, which she remembered of old, and which she had glimpsed from the cab—what a bloody shambles! She longed for Paris again. She longed to stretch her lungs in Paris. These people in Bursley did not suspect what Paris was." Curious tricks the memory plays us. We forget the unpleasant features of a past experience and remember the pleasant things. Man is always looking back to a golden age, not merely in history, but also in his own life. Attention does not explain the freaks of memory.

Under certain conditions, indeed, attention may produce confusion and cause one to say the very thing or commit the act that one is striving to avoid. Freud[1] mentions a young physician "who timidly and reverently introduced himself to the celebrated Virchow with the following words: 'I am Doctor Virchow.' The surprised professor turned to him and asked: 'Is your name also Virchow?'" The young man had evidently fixed his attention on what he would say and, perhaps, on what he should *not* say, and then said the wrong thing.[2]

[1] *Psychopathology of Everyday Life*, p. 100.

[2] Freud ascribes this error of the young physician to the fancied identification of himself with Virchow. This suppressed thought of identification, with its associated feelings, Freud calls an "ambition-complex." To the writer, however, the explanation seems to be the simpler one given above.

An acquaintance of the writer relates a similar instance from his own experience. The husband of one of his friends died and, in the course of time, the widow married again. After the second marriage, when addressing her, he continually caught himself with her former name half spoken. This tendency has not ceased even after the lapse of several years. He ascribes it to his fear lest he make the mistake and to the fact that before addressing her he thinks her new name and then cautions himself against speaking that of her former husband. Her former name is thus unintentionally emphasized.

Another bit of evidence indicative, also, of the inadequacy of the attention theory as a complete explanation is that in well-organized minds memories do not owe their existence to their own content alone. It is always a question of the relation of that content to other memories, active or suppressed. We recall by association. Since associations may be real or fancied, pleasant or unpleasant, they leave the door open to all sorts of emotional conflicts with a resulting repression of memories. This suppression of thoughts and experiences may nullify the influence of attention. Charles Darwin, with his keen, analytic mind, observed this tendency to forget disagreeable thoughts in himself. "I had during many years followed a golden rule," he says in his *Autobiography*, "namely, that whenever a published fact, a new observation or thought, came across me which was opposed to my general results, to make a memorandum of it without fail and at once; for I had found by experience that such facts and thoughts were far more apt to escape from the memory than favorable ones." Nietzsche also noted the tendency of disagreeable thoughts to vanish from memory. "'I have done that,' says my memory. 'I cannot have done that,' says my pride, and remains inexorable. Finally my memory yields." [1]

[1] *Jenseits von Gut und Bösen.* Viertes Hauptstück, 68.

Curiosities of memory would hardly be complete without reference to some of the equally strange instances of forgetfulness. The two are really one, and, of the two aspects of this unitary process, forgetfulness probably requires explanation rather than memory itself. Recently Freud[1] has undertaken an analysis of why we forget and has found, as he believes, abundant evidence in support of the view that forgetfulness is the result of conflict and repression.

"The motive of forgetting," he says, "is always an unwillingness to recall something which may evoke painful feelings. . . . This motive universally strives for expression in psychic life, but is inhibited through other and contrary forces from regularly manifesting itself. . . . A different factor steps into the foreground in the forgetting of resolutions; the supposed conflict resulting in the repression of the painful becomes tangible, and in the analysis of the examples one regularly recognizes a counter-will[2] which opposes but does not put an end to the resolution. . . . The same conflict governs the phenomena of erroneously carried-out actions. . . ."[3]

In speaking of erroneous actions Freud continues: "The first question (as to the origin of thoughts and emotions which find expression in faulty actions) we can answer by saying that in a series of cases the origin of the disturbing thoughts can readily be traced to repressed emotions of the psychic life. Even in healthy persons, egotistic, jealous, and hostile feelings and impulses, burdened by the pressure of moral education, often utilize the path of faulty actions to express in some way their undeniably existing force which is not recognized by the higher psychic instances" [impulses or ideals].

[1] *Psychopathology of Everyday Life.*

[2] This is the translator's word, but, in the opinion of the present writer, counter-force expresses the thought more correctly.

[3] *Op. cit.*, pp. 331–333.

Freud gives an illustrative instance from his own experience: "While taking an examination in philosophy as a minor subject I was questioned by the examiner about the teaching of Epicurus, and was asked whether I knew who took up his teachings centuries later. I answered that it was Pierre Gassendi, whom two days before, while in a café, I happened to hear spoken of as a follower of Epicurus. To the question how I knew this I boldly replied that I had taken an interest in Gassendi for a long time. This resulted in a certificate with a *magna cum laude*, but later, unfortunately, also in a persistent tendency to forget the name of Gassendi. I believe that it is due to my guilty conscience that even now I cannot retain this name despite all efforts. I had no business knowing it at that time." [1] "In former years," continues Freud in this same connection, "I observed that of a great number of professional calls I only forgot those that I was to make on patients whom I treated *gratis*, or on colleagues."

A similar tendency to forget what has unpleasant associations has been mentioned by Doctor Ernest Jones: "In my own life," he says, "I have noted numerous instances of a purposeful forgetting of appointments, particularly with patients. If a given patient is very tedious and uninteresting, I am very apt to forget that I have to see him at a certain hour, and if a doctor telephones to ask whether I can see an interesting case at that hour I am more likely than not to tell him that I shall be free then. Indeed, I can recall several annoying quandaries that this habit has led me into." [2]

An instance illustrating the same tendency to forget the unpleasant has recently been reported to the writer by an acquaintance. This man has reached his fiftieth birthday, but still has a large amount of work laid out and is

[1] *Op. cit.*, p. 45.
[2] *American Journal of Psychology*, vol. 22, p. 477.

loath to think that he has passed the meridian of life. The unpleasantness of this thought makes it impossible for him to remember his age. When required to give it he must invariably figure it out from the year of his birth. Even then he has difficulty because he is always uncertain of this date. His birthday frequently passes without the fact coming into consciousness.

This tendency to repress unconsciously the unpleasant sometimes results in curious displacements and substitutions. The disagreeable thought may then be unintentionally expressed. An interesting experience is reported by Brill.

A wealthy but not very generous host invited his friends to an evening dance. "Everything went well until about 11.30, when there was an intermission, presumably for supper. To the great disappointment of most of the guests, there was no supper; instead, they were regaled with thin sandwiches and lemonade. As it was close to election day, the conversation was centred on the different candidates, and as the discussion grew warmer one of the guests, an ardent admirer of the Progressive candidate, remarked to his host: 'You may say what you please about Teddy, but there is one thing you must admit, he can always be depended upon to give one a *square meal*'—wishing to say 'deal.'"[1]

Freud also cites a similar instance from his own experiences: "While writing a prescription for a woman who was especially weighted down by the financial burden of her treatment, I was interested to hear her say very suddenly: 'Please do not give me *big bills*, because I cannot swallow them.' Of course she meant to say *pills*."[2]

According to Freud, the same psychological causes underlie the forgetting of proper names, and the recalling of trivial, irrelevant experiences of childhood instead of

[1] *Journal of Abnormal Psychology*, vol. 8, p. 314.
[2] *Op. cit.*, p. 103.

the more important ones that profoundly affected us at the time. In each of these apparently different instances, in Freud's opinion, repression of certain memories and substitution of others occur. "In both cases we deal with the failure of remembering; what should be correctly reproduced by memory fails to appear, and instead something else comes as a substitute. . . . The stopping and straying of the reproducing function indicates more often than we suppose that there is an intervention of a prejudicial factor, a tendency which favors one memory and at the same time works against another."[1] And this prejudicial factor, Freud thinks, is the displeasure which the arousal of the suppressed memory would cause.

Mislaying objects is, of course, an instance of forgetting, and Freud brings these mistakes under the same general principle. "If one looks over the cases of mislaying it will be difficult to assume that mislaying is anything other than the result of an unconscious intention."[2]

"A man was urged by his wife to attend a social function in which he not only took no interest, but which he was sure would actually bore him. Yielding to his wife's entreaties, he began to take his dress-suit from the trunk when he suddenly thought of shaving. After accomplishing this he returned to the trunk and found it locked. Despite a long, earnest search, the key could not be found. A locksmith could not be found on Sunday evening, so the couple had to send their regrets. On having the trunk opened the next morning the lost key was found within. The husband had absent-mindedly dropped the key into the trunk and sprung the lock. He assured me," says Brill, "that this was wholly unintentional and unconscious. It must, however, be borne in mind that he did not wish to go. There was a motive, as we see, in the mislaying."[3]

Forgetting, then, in Freud's opinion, resolves itself

[1] *Op. cit.*, pp. 60–61. [2] *Op. cit.*, p. 148.
[3] A. A. Brill, *Psychoanalysis: Its Theory and Practical Application*, p. 219.

into repression of memories through conflict. Ideas associated with strong emotions suppress experiences the thought of which is repugnant to the dominating emotion. In other words, it is a defense against recalling experiences unpleasant in themselves or which are associated directly or indirectly with disagreeable memories. The associated interaction, however, sometimes goes astray, and while we wish to forget one thing we actually forget that which we desire to recall. This may happen when what we are anxious to forget forms an associative connection with what we wish to remember. Names may be forgotten, according to Freud, who seems to regard name-forgetting as typical, in this respect, of forgetting in general, "when the name itself touches something unpleasant, or when it is brought into connection with other associations which are influenced by such effects. So names can be disturbed on their own account or on account of their nearer or more remote associative relations in the reproduction."[1] An illustration will make this clear.

"During the weeks just before Christmas," says Doctor Frink,[2] "a gentleman was asked by two or three different people where certain books could be purchased. He happened to know that the books in question were kept in stock by a firm of publishers on Twenty-third Street, but though he recalled the exact location of this store, and was able to give accurate directions for finding it, he could not remember the name of the firm.

"A few days later, when he mentioned the circumstances to me, I was able to supply the missing name (Putnam), and we attempted to analyze his forgetting, with the following results:

"Upon concentrating his mind upon the name in question he immediately recalled that some years before he had gone to Putnam's in search of a certain book which he

[1] *Op. cit.*, pp. 52–53.
[2] *Journal of Abnormal Psychology*, vol. 8, p. 386.

wished to present to a young lady he much admired. Having obtained the book, he called upon her, but, contrary to his hopes, she received him and his gift in a manner so cold and forbidding as to occasion him not only extreme embarrassment but also a degree of wrath.

"This memory, together with others of a similar kind, which furnished mortifying evidence of his inability to win a high place in the lady's esteem, formed a complex of such an undoubtedly painful nature that one might readily suppose it capable of causing resistances against remembering that the above-mentioned firm of booksellers exists. But this complex does not account for the fact that *after* he had recalled the existence of this firm, as he did without apparent difficulty, the *name* of the firm still eluded him. It was evident, then, that the resistance to the name belonged to some complex still undiscovered, and I, therefore," says Frink, "urged him to continue his associations.

"After a short pause, during which he felt that he was 'thinking of nothing,' he stated that he had a very vague mental picture of some person with a round, red face and wearing a blue coat, but he was quite unable to say who this person might be. Next he found himself thinking of a tall cupboard in a house where he had lived up to his eighth year. Then came a memory of himself as a child, sitting with his younger brother on the floor before this cupboard and playing with a colored picture-book. At this point he suddenly realizes the identity of the red face. In the picture-book was a representation of General Israel Putnam, with a very red face and a very blue coat, making his famous escape from the British by riding on horseback down a flight of stone steps.

"Then there occurred to him the incident by which the forgetting is apparently determined. When he was about seven years of age, he and his brother, stimulated by the picture of the doughty general's exploit, decided to 'play

Israel Putnam,' by carrying each other down the stone stairs which led to the cellar of their house. But while carrying out this plan it occurred to the older boy, who at this moment was acting the part of Putnam's horse, that to drop his brother upon the stone steps would add greatly to the zest of the proceedings. This happy inspiration was no sooner received than put into effect. The small brother, suddenly finding himself at the bottom of the steps in a very contused condition, set up a wail which promptly brought the mother of the children upon the scene and placed the elder brother in imminent danger of chastisement. But in this emergency the same fertility of invention which got him into trouble got him out again. For by lying with great power and persuasiveness he convinced his mother that his brother's fall was purely accidental and escaped being punished.

"To this incident the forgetting of the name of Putnam may, I think, be attributed. I realize, however, that some may doubt whether the memory of this episode, though of evident significance at the time it was formed, could have any effect whatsoever after a lapse of more than twenty years. But in this connection it should be borne in mind that the memory must not be regarded as an isolated one, but as a part of great complexes which concern the telling of lies, the subject's family, and the malicious pleasure derived from making other people suffer. It is perhaps worthy of note, also, that the forgetting occurred just before Christmas—that is, in a period which sets the entire 'family complex' on the *qui vive*, and not only stimulates feelings of affection and good-will, but, because of the sometimes painful necessity of furnishing expensive material evidence of regard, occasionally inspires sentiments of a less noble and benevolent character. In view of this latter fact, one may conceive that the subject's first association may perhaps not be so irrelevant as it seems."

It must not be thought that failure to recall is inten-

tional. The defensive tendency is a subconscious process. "I have collected the cases of neglect through forgetting which I have observed in myself," says Freud,[1] "and endeavored to explain them. I have found that they could invariably be traced to some interference of unknown and unadmitted motives—or, as may be said, they were due to a counter-will. In a number of these cases I found myself in a position similar to that of being in some distasteful service; I was under a constraint to which I had not entirely resigned myself, so I showed my protest in the form of forgetting."

"Ignorance of the law is no excuse" is thus seen to have a psychological basis, because the wish to do the forbidden act makes it easy to forget the prohibiting law.

It need hardly be said that the defensive tendency which underlies Freud's theory does not always gain the upper hand. The realm of thoughts and emotions is too extensive and complex for that. Amid the play of psychic forces, thoughts, and especially emotions, may arise in opposition to the suppression of the disagreeable. Moral convictions may, according to circumstances, tend to suppress or recall a memory. The desire to boast, for example, in a man of low moral standards, may cause him to remember and even to tell of an occurrence which in another would be suppressed.

It is evident from Freud's analysis that forgetting is not an accidental occurrence. It always has a cause, and this cause involves a motive. We may or may not be able to discover the motive, but it is there. Freud has rendered a service by the clearness with which he has demonstrated the vagueness of the usual explanation. His analysis, whether correct in particular instances or not, reveals the amazing intricacies of the mental life, and pictures certain causes of memory failures as well as of errors in speech and action. The explanations usually given, as inattention,

[1] *Op. cit.*, pp. 163–164.

absent-mindedness, lack of interest, etc., do not explain. If the writer were to venture a criticism of Freud's theory, however, it would be that it is too limited. Is the motive of forgetting "always an unwillingness to recall something which may evoke painful feelings"? The writer doubts it. That we tend to forget the unpleasant is undeniable. But to assume this to be practically the only motive of forgetting makes the mental processes too restricted, too consistently uniform. Conflict, suppression, reinforcement, and integration are operative, in turn and together, but the mental life is not so simple as to have essentially one motive. It is well known, for instance, that men are prone to become offensively autocratic when suddenly promoted from a subordinate position to one that places them over those among whom they formerly worked. They usually forget the causes of earlier dissatisfaction and follow the objectionable practices of their earlier foremen or managers, with, however, this difference—they are inclined to be more offensive in their exactions. Of course it may be said that they wish to forget their former condition of servitude, but there are other factors, such as pride in ostentatious display of authority, letting loose all of the suppressed desires to dominate—the pleasure that man feels in commanding others, the primitive elation in merely ordering and seeing the orders executed.

The writer, in his analysis of his own memory failures in thoughts and actions, has found much evidence to support Freud's theory. Conflict there certainly is, and repression as well. It is probable, indeed, that all forgetting is due to conflicts and suppressions of one sort or another. There seem, however, to be many causes of these conflicts, some of which, perhaps, are more common than the others, but any one of which may serve as an underlying motive. The instance of the man who locked his key in his trunk, for example, which Freud quotes approvingly from Brill, impresses one as fitting the explanation to the theory.

Whatever was the cause in that case, it is entirely conceivable that a man may look forward to a social event with keen anticipation, but may also have work on hand that occupies his mind, and which he is anxious to finish. In such a case the conflict is between enjoyable thoughts, and the final repression is motived by other causes than the disagreeable. To say that the greater zest for the one than the other makes one, by comparison, unpleasant, is only playing with words. But, notwithstanding criticism, Freud's contribution is of inestimable value. He has gone below the general causes of forgetfulness, and shown that there are specific motives which may be discovered, and one of these motives, perhaps the most frequent, he has isolated and examined.[1]

Memory, then, is a process—a complex nervous process—and, like all processes, it can be furthered or hindered. The inclusion of conscious experience in the definition of memory, as when we say that to be remembered an event must be recognized as a part of our past experience, limits it by definition to the facts which have been in our personal consciousness. It begs the question. All experiential modifications of the nervous system which are retained and can be reproduced so as to exert an influence upon subsequent action are memory. As a matter of fact, conscious memory is only one type of memory. Many experiences which do not become a part of our conscious mental content influence our actions as truly as those of which we are aware. Our "feeling" and "intuitions" regarding people are illustrations. We are convinced that a man is not frank and open, but can give no reason for our belief. The only intelligible explanation for this conviction is that some look or movement, or something else in his past relations with us, made an impression without coming into clear consciousness. So-called organic memory, with all of its ramifications, is an illustration in a wider field.

[1] An unusually clear statement of Freud's theory, by Doctor Ernest Jones, may be found in the *British Journal of Psychology*, vol. 8, p. 33.

Then, again, the actions of the lower animals are suggestive. Feed a dog an appetizing dish made intensely bitter, and he is likely soon after to decline the food served in the same way but without the bitter ingredient. Is this not memory? Yet few would say that the dog consciously recalled his past experience.

This view of memory brings it into line with the curious instances that we have quoted, and in which the element of "recognition" did not enter. Considering memory as a process, all of these facts seem clear. A nervous process has varying degrees of intensity. Some are too weak to become factors in consciousness, though they may exert an influence upon the individual; indeed, later, they may rise above the level of consciousness. This is seen in those occasional moments when one is spoken to while reading an interesting book. A person thus absorbed does not hear the words, does not even know that he is addressed. Yet half an hour later he may suddenly become aware of the fact. There are all sorts of memory variants, some of which are so spectacular as to suggest occult explanations to those seeking supernatural causes. But these unusual variants can be matched by facts from every-day life which, because of their commonness, are not believed to require an explanation.

Memory regarded as a process is also consistent with the strange cases of forgetfulness to which reference has been made. A nervous impulse traversing certain pathways is exposed to many interferences. Disturbance of nervous processes has been proven in such cases as associative and reproductive inhibition, and in assuming further conflicts and repressions we are only enlarging the field of interference. Memory and forgetfulness are evidently subject to certain principles, some of which have already been discovered; and to the extent to which they are known memory can be improved. To this phase of the subject we accordingly turn.

CHAPTER VII

MEMORY AND ITS IMPROVEMENT

We have been speaking of certain special and unusual cases of recall of past experience. They are significant for the psychology of memory, but for the affairs of every-day life the practical question is, How may one's own memory be made efficient? In answering this question we should constantly bear in mind that an efficient memory is selective. It does not reproduce past experiences impartially. Certain facts which we have observed, heard, or read are important for the matter in hand, and other things, however much they may bear on other questions, have no present significance. If one will notice the arguments and statements of others, one cannot fail to observe the devious mental wanderings from the point. George Meredith gives a good illustration in *Evan Harrington*. Evan, when horseback riding, discovered Polly Wheedle shivering under a bush in the rain:

"Bellowing against the thunder, Evan bade her throw back her garment and stand and give him her arms, that he might lift her on the horse behind him.

"There came a muffled answer, on a big sob, as it seemed. And as if heaven paused to hear, the storm was mute.

"Could he have heard correctly? The words he fancied he had heard sobbed were:

"'Best bonnet . . .'

"Evan stooped his shoulder, seized the soaked garment, and pulled it back, revealing the features of Polly Wheedle.

"'Oh, Mr. Harrington; oh, ain't I punished!' she whimpered.

. . . . . .

"'And what have you been doing to be punished? What brought you here?' said Evan.

"'Somebody drove me to Fallowfield to see my poor sister Susan,' returned Polly, half crying.

"'Well, did he bring you here and leave you?'

"'No; he wasn't true to his appointment the moment I wanted to go back; and I, to pay him off, I determined I'd walk it where he *shouldn't* overtake me, and on came the storm. . . . And my gown spoilt and such a bonnet!'

"'Who was the somebody?'

"'He's a Mr. Nicholas Frim, sir.'

"'Mr. Nicholas Frim will be very unhappy, I should think.'

"'Yes, that's one comfort,' said Polly ruefully, drying her eyes. . . .

"'You look very pretty.' . . .

"'I can see myself a fright, like my Miss Rose did, making a face in the looking-glass when I was undressing her last night.'

. . . . . .

"'My Miss Rose—what was I going to tell? Oh!—my Miss Rose. You must know, Mr. Harrington, she's very fond of managing; I can see that, though I haven't known her long before she gave up short frocks; and she said to Mr. Laxley, who's going to marry her some day, "She didn't like my lady, the Countess, taking Mr. Harry to herself like that." I can't abear to speak his name, but I suppose he's not a bit more selfish than the rest of men. So Mr. Laxley said—just like the jealousy of men—they needn't talk of women! I'm sure nobody can tell what we have to put up with. We mustn't look out of this eye, or out of the other, but they're up and—oh, dear me! there's such a to-do as never was known—all for nothing!——'

"'My good girl!' said Evan, recalling her to the subject-matter with all the patience he could command.

"'Where was I?' Polly travelled meditatively back. 'I do feel a little cold.'"

Evidently, recalled thoughts—memory—need direction and guidance. What is it that guides? It is the thought about which we are conversing—the central idea around which related memories should cluster. The material from which this selection is made comes, of course, from past experience; but experience is always varied. Every idea has been connected with many others. And it is here that the purpose of the moment plays its controlling part when it is kept rigorously in mind. The failure to keep to the point—to progress in one's thinking and talking—is commonly caused by carelessly losing the thread of conversation or thought.

Naturally, much depends upon the intensity of the impressions, and for deepening the impress, repetition, recency, vividness, and the number of associations focussing upon the idea or event that is to be remembered are important. Retention, after the impression has been made, is determined by the quality of brain-tissue. Consequently, any improvement here is produced indirectly. As in other mental matters the effect of hygienic living cannot be overestimated. A vigorous metabolism, by rapid elimination of the waste products caused by wear and tear, and by rebuilding the nervous structures, continually rejuvenates the tissues and keeps them "fit." The effect of this is appreciated when destruction of tissue exceeds construction, as when one becomes "worn out" from overwork, lack of exercise, or from temporary fatigue. The mind, and with it the memory, then refuse to work. The psychological significance of what has been said in earlier chapters about exercise, food, and fatigue is therefore obvious.

In the last analysis, however, we must accept our brain-tissue as it is and endeavor to make the most of it. After hygienic living, improvement of memory requires conform-

ity to rules and principles that grow out of the memory process. The purpose of the experiments cited in this chapter is to discover some of the principles inherent in memory. But before discussing these investigations it may be well to mention, briefly, a few of the facts underlying retention and recall.

The fundamental psychological law of memory is, of course, based upon association of ideas, and the investigations of retention and recall are attempts to ascertain under what conditions associations are firmly established with the least expenditure of time and energy. Stated in its simplest psychological terms the law of association is, that if two ideas have been in the mind simultaneously or in immediate succession the recurrence of one of them tends to bring the other in its train. I meet a man, for example, whom I formerly knew quite well, but whose name I cannot remember. I must recall it, however, for a friend will join us soon to whom the man must be introduced, and I do not wish to admit that I have forgotten his name. My mind runs over the period of our former acquaintance. We were together in a certain town, we had several friends in common, whose names come back as the circumstances are recalled. Events long forgotten follow one another in more or less serial order; then, quite suddenly, perhaps, as I remember a little play in which we both participated, the desired name bursts upon me. The writer has been trying to describe a bit of personal experience. It was a long series of associations and several times the name seemed about to come, but still it eluded him. Finally, however, the right clew, the event with which the name was in closest association, was reached, and then it followed as a matter of course.

Neither the statement of the "law of association," however, nor the description of the process gives the reason for the succession of thoughts or for the recall of any given idea. For this explanation it is necessary to turn to the

nervous system. The connection between ideas rests, ultimately, upon a more fundamental connection between neurones, and upon increased permeability of the synapses joining these neurones. The law should, therefore, be stated in physiological terms, as follows: When two neurones have been active together or in immediate succession, the activity of one tends to excite the other to action. The synapse is the point of functional connection between neurones, and simultaneous or successive action of the two neurones decreases the resistance of their juncture. For this reason the excitation of one easily extends to the other. The change in the synapse, resulting from the passage of a nervous impulse from one neurone to another, is the physiological basis of association, as of habit. Association is much more complex than this so-called law implies, but it is not our present purpose to examine its more intricate manifestations. The important fact to observe here is that memory proceeds according to law and order.

There are, to be sure, cases in which memory seems to be independent of association. Ideas, at times, appear to come into the mind of their own accord. We are sometimes obsessed by a word, a tune, or a face. So far as we can discover such ideas are uncaused. There is, however, in the author's opinion, no reason for assuming that this perseverative tendency—the persistence of the activity of the cells of the cortex—violates the principle of association. It is probably due to hidden associations, to similarities or contrasts of which one is not fully conscious, or to old associations which have faded to obscurity. The fact that perseveration is especially noticeable when one is fatigued supports this view. In such a condition the older, more permanently established, associations would naturally obtrude. Associations are much more numerous and controlling than we are inclined to think. Suggest almost any topic, such as anarchist, trades-unions, or walking delegate, to a friend, and you will find that he has very

strong opinions, though he may never have given the ideas a moment's conscious reflection. The associations that give approval or disapproval have been formed wholly unconsciously through the influence of newspaper statements or conversations. Perseveration may therefore be explained without recourse to free ideas, for which there is at present no convincing evidence.

These apparently detached ideas are sometimes bridges over which one passes from memory to imagination. On rare occasions they offer new points of view and a great discovery may follow. The mental attitude toward the questions raised is important here, and knowledge plays an inestimable rôle.

Knowledge as a factor in memory has received too little attention. The more we know about a subject the more easily and accurately do we remember what we read concerning it. The reason, of course, is that we see more meaning in what we read and, because it has a richer significance, associations are more numerous and intelligible. Knowledge is also necessary for flashes of insight. This is the basis for the statement attributed to Thomas Edison, that "genius is not inspiration, but perspiration."

Adults are prone to think that memory is a matter of age. Children, they say, remember easily but maturity causes forgetfulness. Investigations,[1] however, do not support this view. Children seem to excel adults in rote-

[1] A. Binet and V. Henri, *L'Année psychologique*, vol. 1, p. 1. B. Bourdon, *Revue philosophique*, vol. 37, p. 148. T. L. Bolton, *American Journal of Psychology*, vol. 4, p. 362. O. Decroly and J. Degand, *L'Année psychologique*, vol. 13, p. 122. E. N. Henderson, *Psychological Review, Monograph Supplement*, no. 23, 1903. J. Jacobs, *Mind*, vol. 12 (old series), p. 75. Marx Lobsien, *Die experimentelle Pädagogik*, vol. 3, p. 151. E. Meumann, *Vorlesungen z. Einführung in d. experimentelle Pädagogik*, vol. 1, pp. 170–203; *The Psychology of Learning*, translated by J. W. Baird, pp. 245 *ff*. A. Netschajeff, *Zeitschrift f. Psychologie und Physiologie d. Sinnesorgane*, vol. 24, p. 321. Adolf Pohlmann, *Experimentelle Beiträge z. Lehre vom Gedächtnis*, Berlin, p. 55 *ff*. Rudolf Wessely, *Neue Jahrbücher f. das klass. Alterthum u. f. Pädagogik*, vol. 16, pp. 279, 373. W. H. Winch, *British Journal of Psychology*, vol. 1, p. 127; 2, p. 52.

learning, because they are more accustomed to this kind of memory work. As soon, however, as adults have had practice they surpass children. Mature persons are unwilling to submit to the drudgery of mechanical learning. They resent memorizing conjugations and declensions, or lists of words. Children, on the other hand, rather enjoy such work and frequently repeat in play what they have learned. Practice with them is more regular and persistent, and it is practice that counts in memory, as in other things.

Memory in children improves with age, though periods without improvement have been observed. These exceptions seem to occur when the development of organs and functions produces excessive drain upon the vitality. It should be mentioned, in this connection, that most of the experiments have been made with those of fourteen years or younger, and usually the memory tests were given immediately after the material had been learned. In a few instances twenty-four hours or several days intervened.

An experiment by Wessely[1] throws some light upon the relation between permanent memory and age in those under seventeen or eighteen. Boys were asked to write as much as they could remember of a poem which they had committed to memory a year or more before. The result showed that, so far as these boys were concerned—there were twenty-three or more in each of the six classes tested—retention gradually increased from twelve years of age to fifteen or sixteen, when it appeared to reach its maximum. Wessely also tested pupils from eleven or twelve to seventeen or eighteen, using Latin words with which they were unfamiliar. The memory test consisted in associating these words with their German equivalents. Then, twenty-four hours, one week, and one month later the German words were given, and the boys were asked to write the respective Latin equivalents. The capacity

[1] *Op. cit.*

to retain and recall gradually increased from the youngest, who gave the poorest results, to those of thirteen or fourteen, who were the best. At seventeen or eighteen, again, some increase in retention was indicated.

Pohlmann[1] found that children fourteen years of age retain considerably more than one and one-half times as much as nine-year-olds. At about fourteen he observed a decline, due probably to physiological causes. This was followed by a second increase in capacity to retain and recall, which continued to the twentieth year, where his investigation ended. Beyond twenty years no systematic attempt has been made to follow the relation between permanent memory and age.

Meumann thinks that the limit of improvement in the ability to commit to memory is reached at about twenty-five years of age. The few tests that have been made on adults, however, indicate increasing ability much later in life. Ebbinghaus, for example, tested himself at fifty-two years of age, and found that he could learn nonsense-syllables quite as readily as he could shortly after thirty.[2]

In a more recent investigation[3] high-school students averaging from sixteen to seventeen years of age retained poetry better than those younger or older. With prose, however, the most efficient memory "appears much later in life, and the more abstract and difficult the material the later it appears." On the whole, this investigation sustains the earlier conclusions, that memory of material with meaning improves until the period when the mental powers in general begin to decline.

The reason for the better memory of adults is greater ability to concentrate their attention, wider knowledge, with its wealth of associations, and the will to remember as represented in their attitude toward their work. Interest in what one is doing, with its accompanying zeal to

[1] *Op. cit.* [2] *Grundzüge d. Psychologie*, erste Auflage, vol. 1, p. 622.
[3] D. O. Lyon, *Archives of Psychology*, no. 34.

achieve results, concentrates the attention on the work and tends to eliminate disturbances. There are, of course, variations from the rule, both among adults and children. The power of concentration, the amount of reflection, and the mental type of the reader, all play their rôle. But it is safe to say that in the vast majority of those under forty-five or fifty who are unable to remember what they hear or read, the fault lies in the absence of endeavor.

Another preliminary question regarding memory is its relation to intelligence. Do brighter children remember better? This cannot be answered definitely. Winch[1] tested boys and girls ranging from eight years of age to a little over fourteen. He made two kinds of experiments. In the first set twelve consonants were read aloud. The children wrote the consonants from memory immediately after they were given. Winch found a direct relation between memory and intelligence, as indicated by success in school studies. It should not be forgotten, however, that school methods too commonly put a premium on rote-learning. It is, therefore, pertinent to ask whether a good memory of the sort investigated by these tests and good school marks do not largely overlap.

Pyle,[2] testing the members of several college classes, found so slight a correlation as to be practically equivalent to a denial of any mutual relation. Lyon, on the other hand, concluded[3] that "the students who rank highest in their classes and who may be classed as the most intelligent have, as a rule, the best memories." An examination of Lyon's tests, however, indicates that the differences are not sufficient to warrant a definite statement. Indeed, the investigator himself says: "The differences are not marked. Upon taking any one form of material, contrary results may be obtained."

Henderson, again, observed no correspondence between

[1] *Op. cit.* [2] *Journal of Educational Psychology*, vol. 2, p. 319.
[3] *Journal of Philosophy, Psychology and Scientific Method*, vol. 9, p. 74.

class standing and memory in the grammar-school, but he did find a correlation among older pupils. This difference was quite likely due to the increased ability of those who were older to understand the meaning of what they read or heard and to the more abundant associations.

Ebbinghaus[1] measured the ability and memory of gymnasium pupils. Those included in his tests ranged from eleven years of age to eighteen. Three kinds of tests were used: A memory test of numbers of one syllable in varying order, an arithmetical test of simple addition and subtraction, and a third, consisting of prose selections, suited to the ages of the different children, with occasional syllables and words omitted. The omissions were indicated by dashes, and the children were to supply the omissions so as to make sense. The results showed that the youngsters with the best memory—the numbers were to be written down in their order as soon as heard—were not the ones who displayed the most intelligence in the other tests. This investigation is more accurate than that of Winch, because the memory and intelligence tests do not overlap. They do not make demands on the same sort of ability.

Experiments made by Pohlmann also indicate that memory varies with age rather than with intelligence, but Pohlmann adds that in the great majority of cases high degrees of memory and intelligence seem to be associated. The disagreement regarding this question is probably due to the fact that there are different kinds of abilities. Good memory and unusual intelligence will then be correlated when the same or similar mental processes are involved in each. This will also explain the fact that different kinds of material produce varying results, as was found by Lyon.

When one looks over the investigations[2] on the compara-

[1] *Zeitschrift f. Psychologie und Physiologie d. Sinnesorgane*, vol. 13, p. 401.

[2] Mary W. Calkins, *Psychological Review*, vol. 5, p. 451. Jonas Cohn, *Zeitschrift f. Psychologie und Physiologie d. Sinnesorgane*, vol. 15, p. 161. Stephen S. Colvin and E. J. Myers, *Psychological Review, Monograph Supplement*, no. 44, 1909. Jacopo Finzi, *Kraepelin's Arbeiten*, vol. 3, p. 289. C.

tive memory effect of seeing or hearing words, numbers, nonsense-syllables and sentences, or, again, of articulating internally what is heard or seen, one also finds much disagreement.

So far as the comparative advantage to memory of hearing or seeing is concerned, the method of presenting the material is not a certain criterion of the manner in which it will be imaged in preparation for remembering it. For example, a list of words or of dates is given to three men; one may think them in auditory images, the second in visual, and the third, again, may go through the incipient movements of pronouncing them. Most people, however, are not predominantly auditory, visual, or motor minded. They use one or another kind of imagery, according to the convenience or suggestion of the moment, influenced chiefly, of course, by the definiteness of their tendency to one or the other method of thinking what is seen or heard. The problem may be approached from two sides: first, What is the comparative efficiency of the manner of presenting material to be memorized? and, second, How is the memory material worked up for reproduction? This last involves the further question, How does the manner in which it is worked up vary with the auditory, visual,

J. Hawkins, *Psychological Review*, vol. 4, p. 289. V. A. C. Henmon, *Psychological Review*, vol. 19, p. 79. F. Kemsies, *Zeitschrift f. pädagogische Psychologie*, vol. 2, p. 21, and vol. 3, p. 171. E. A. Kirkpatrick, *Psychological Review*, vol. 1, p. 602. W. A. Lay, *Experimentelle Didaktik*, 1910, pp. 297, 351 M. Lobsien, *Zeitschrift f. Psychologie und Physiologie d. Sinnesorgane*, vol. 27, p. 34. G. E. Müller and A. Pilzecker, *Zeitschrift f. Psychologie und Physiologie d. Sinnesorgane*, Ergänzungsbd. 1. G. E. Müller and F. Schumann, *Zeitschrift f. Psychologie und Physiologie d. Sinnesorgane*, vol. 6, pp. 81 and 257. E. Meumann, *Vorlesungen z. Einführung in d. experimentelle Pädagogik*, vol. 1, pp. 493 *ff.* *The Psychology of Learning*, pp. 191 *ff.* Hugo Münsterberg and J. Bigham, *Psychological Review*, vol. 1, p. 34. A. Netschajeff, *op. cit.*, vol. 24, p. 326. Christo Pentschew, *Archiv f. d. gesamte Psychologie*, vol. 1, p. 417. Adolf Pohlmann, *op. cit.*, pp. 179 *ff.* J. Segal, *Archiv. f. d. gesamte Psychologie*, vol. 12, p. 124. M. C. Schuyten, *Archives de Psychologie*, vol. 5, p. 245. A. von Sybel, *Zeitschrift f. Psychologie und Physiologie d. Sinnesorgane*, vol. 53, p. 257. L. G. Whitehead, *Psychological Review*, vol. 3, p. 258.

and motor minded persons, and what is the influence of the method of presentation, or the kind of material employed, in determining the answers to these questions? Unfortunately, these several problems have not always been distinguished in the investigations, and this is probably one of the causes of the disagreement.

Henmon endeavored to ascertain the effect upon retention of the several ways of presenting memory material. He used concrete nouns, numbers, and nonsense-syllables. The tests were made upon six young men and women. The auditory method of imparting the material yielded the best results in the three sorts of tests, and that too, regardless, apparently, of the imagery to which the different persons were accustomed. Kemsies, Hawkins, and von Sybel also found that what is heard is retained and reproduced better than what is seen.

Kirkpatrick, on the other hand, says that school children remember objects seen better than visual words. This agrees with the observations of various investigators that children use images of particular objects in their thinking. Miss Calkins, experimenting with college women, and substituting lantern-slides for objects, came to essentially the same conclusion. Finzi, Müller and Schumann, Müller and Pilzecker, and Meumann found vizualizers more accurate than those of the auditory type, but Meumann thought them slower. Bigham concludes that visual and auditory memory combined greatly reduce the errors. His investigation indicates that memory is helped by calling to aid as many sorts of associations as possible, instead of limiting oneself to those that grow out of the individual's mental characteristics. An all-around developed imagery would then seem to be conducive to a good memory. Meumann, however, believes that children should first learn to utilize the memory-aids which coincide with their mental peculiarities, and that only after they have gained what advantage they can from these should they be trained

to improve their memory by enlarging their memory-aids beyond these "innate" characteristics. One is inclined to agree with Meumann when recalling such instances as the school-days of Justus von Liebig. The story runs, as once related by Liebig[1] himself, that on one occasion when the director of the gymnasium visited young Liebig's class and heard his wretched recitation, he told him that he was the plague of his teacher and the sorrow of his parents. When the director asked what so lazy and inattentive a boy could do, Liebig replied that he was going to be a chemist. At this the director laughed uproariously. Finally, Liebig's father was compelled to withdraw him from the gymnasium because he could not keep up with his class. In his mature years Liebig said that the cause of his inability to do the class work was that he had scarcely any auditory memory. He could retain little or nothing of what he heard; and his school made no provision for individual peculiarities.

The significance of these investigations of mental "types" for one's daily life and growth is best understood when one remembers that experiences in the outside world are not limited to one sense. We can usually hear, or see, or respond in a motor fashion, as we will. Consequently, individual differences are provided for without any effort on our part and commonly, also, without attention from us. Most people belong to what may be called the mixed class. They are not wholly visual, auditory, or motor. To be sure, they prefer to see, or to hear, or to write names which they wish to remember, because they retain better what comes through one particular sense-organ, or that upon which they react in a motor manner. But they are not wholly excluded from other sorts of experiences, as was Liebig. Sight plays a prominent rôle in most of our impressions from the outside world. Perhaps this is the reason for the predominance of visual imagery in the majority

[1] *Das Echo*, June 26, 1907, p. 2119.

of people, not even excluding the "mixed class" to which reference has just been made. There are, of course, numerous individual variations, from the great portrait-painters who "see" the absent model sitting before them to those who mentally see little or nothing. Meumann regards the exclusively visual or auditory person as, in a certain sense, defective. A glance at two or three notable cases will be interesting in showing the occasional strong predominance of the visual and auditory bent of mind.

Inaudi and Diamandi are two reckoning memory-wonders who were investigated by Binet and Meumann. Inaudi was the son of a poor shepherd. He did not attend school until he was fourteen years of age, but at six his brother had taught him to count. His marvellous ability in reckoning was observed at seven years of age, when he could multiply two five-place numbers mentally. Later in life he was able to multiply mentally numbers each of which contained as many as 24 digits. His problems had to be given orally. So lacking was he in visual images that he was confused by the sight of the example upon which he was working. He was able to recall 42 numbers in a longer series read to him, and in twelve minutes he could learn 105 figures by hearing them repeated. In other matters his memory was poor.

Diamandi, on the other hand, employed visual images exclusively, according to Binet; visual and motor if we accept Meumann's investigation. He was the son of well-to-do Greek parents and enjoyed the school privileges of his class. His problems had to be written upon the blackboard. Then, having looked at one for a few minutes, he closed his eyes and the visual representation came. Only after this reproduction of the numbers did he begin his calculation. His own statement was that he saw the numbers "as if they were photographed."

Inaudi, as has been said, was an auditory calculator, and Diamandi did his reckoning visually. The one "heard"

the names of the numbers in his calculations and the other "saw" them. Meumann, however, says that he found that both used "internal speech." Inaudi had observed that hoarseness disturbed him when calculating, and a registering apparatus revealed movements of his tongue and larynx. But, at all events, the vocal movements were only aids for the auditory images of the one and for the visual images of the other.

Binet's investigation of these two calculating prodigies shows that their memories conform to the same laws as those of other people. When Inaudi's memory was assisted by the meaning of the problem it was ten times as efficient, according to Meumann, as his mechanical memory, which is essentially the same as Ebbinghaus found in the average person.

The most famous calculating memory-wonder on record is a university student by the name of Rückle, who gave an exhibition before the Congress for Experimental Psychology at Giessen.[1] He was able to learn 204 figures in thirteen minutes, so that he could repeat them. Rückle differed from Inaudi and Diamandi in having an exceptional memory for other things than figures and numbers. He could learn a series of nonsense-syllables in less than half the time usually required. With Rückle, however, as with others, recall was not based on mere memory. He made use of various devices which gave the figures meaning. For example, he separated them into columns, and each column served as a unit, and in remembering long numbers he divided them into their prime factors. Further than this, his method was to change what he heard into visual images. Then, as he put it, he saw the numbers as clearly as though they were written on a blackboard. There are also striking examples of wonderful memories in other fields than mathematics. Mozart, after hearing but once the *Miserere* of Allegri, wrote it out from

[1] G. E. Müller, *Zeitschrift f. Psychologie*, Ergänzungsbd., vol. 5, p. 186.

memory, and Beethoven produced, among other compositions, the *Ninth Symphony* and the *Mass in D*, after he became deaf.

Turning now to the methods by which memory may be made more serviceable, one of the first questions suggested is that of slow and rapid learning. In certain instances this is, of course, settled by the nervous system. Some people are born slow. But in the great majority of cases the rapidity with which one reads or studies is an acquired habit. Consequently, those who wish to make their memory more efficient will be interested in the comparative value of these two ways of working.

The opinion generally prevails that those who learn quickly forget easily, but experiments[1] do not sustain this view. Practically all of the investigators have found that rapid workers remember more of what they learn than those who are slow. This is true not only of immediate memory—memory tested as soon as the learning is completed—but also of permanent retention. Quantz, for example, observed, in his study of reading, that rapid readers do superior work. They retain more of the substance of what they read or hear than slow readers. Pyle tested eight young men and four women with a selection of easy prose, and, again, the fast learners had the advantage both in the time required for the work and in the amount

[1] Hermann Ebbinghaus, *Grundzüge der Psychologie*, third edition, vol. 1, pp. 672 *ff.*, 686 *ff.* P. Ephrussi, *Zeitschrift f. Psychologie*, vol. 37, pp. 56, 161. E. O. Finkenbinder, *American Journal of Psychology*, vol. 24, p. 8. E. N. Henderson, *op. cit.* Walther Jacobs, *Zeitschrift f. Psychologie*, vol. 45, p. 159. Ernst Meumann, *The Psychology of Learning*, pp. 169 *ff.*, 250 *ff.* G. E. Müller and F. Schumann, *op. cit.* Naomi Norsworthy, *Journal of Educational Psychology*, vol. 3, p. 214. R. M. Ogden, *Archiv f. d. gesamte Psychologie*, vol. 2, p. 93. Christo Pentschew, *op. cit.* William H. Pyle, *Journal of Educational Psychology*, vol. 2, p. 311. J. O. Quantz, *Psychological Review, Monograph Supplement*, no. 5. P. R. Radossawlewitsch, *Das Behalten und Vergessen bei Kindern und Erwachsenen*, Leipzig, 1907. D. Starch, *Journal of Educational Psychology*, vol. 3, p. 209. Lottie Steffens, *Zeitschrift f. Psychologie*, vol. 22, p. 321. E. L. Thorndike, *Psychological Review*, vol. 15, p. 122. Louis G. Whitehead, *op. cit.*

that they retained. Pyle also noticed that the rapid learners in the group with which he worked excelled in accuracy. Miss Norsworthy tested eighty-three students, and after a month had passed the more rapid workers remembered more of what they had committed to memory than those who had learned the assignment with more effort. Essentially the same conclusion, at least for intelligible material, was reached by Lyon.[1] "Those who learn quickly," he says, "remember longest if the material is logical in character. Where the material is 'illogical' and is memorized by motor associations, so to speak, the converse is true."

It appears, then, from these and other experiments that, in reading or studying selections of connected thought, rapidity is economical, provided it does not exceed the speed at which the reader can get the meaning clearly. Beyond this rate haste would obviously be uneconomical. The discovery that the statement "Easy comes easy goes" is not true has far-reaching educational significance.

If a young man plans to enter business or any of the professions, for example, it is of supreme importance that he acquire the ability to tear the meaning from pages at a glance. A business man should be able to understand the report of a department manager as his eye runs it over; and a lawyer cannot be long in getting the significance of a legal document if he would win his case. Further, the amount that one must read in law, medicine, science, literature, or theology to become proficient is enormous, and it is continually increasing. The young man who hopes to reach a position of importance must learn to cover ground rapidly and to note the landmarks as he passes.

But there is still another phase of this same question. Often one consults books for a definite purpose, to secure information about a certain matter. A lawyer, for example, is looking for opinions, decisions, or analogous cases to settle a legal point. He must finger many books but he

[1] *Op. cit.*

has not time to read them through. Success in this requires ability to get the contents of a page at a glance. He does not read it, but he must grasp the substance. Physicians have many more medical journals than they can read through if their practice is extensive. They need to see the meaning of the articles as they turn the pages.

For the lecturer, writer, or general reader who wishes to be informed, the situation is essentially the same. Scientific, historical, or other information is widely scattered through books and journals. The man who reads slowly is heavily handicapped. Rapid readers cover half a dozen books in an evening, getting much as they skim along and reading selected portions with more care. Many books are not worth reading through. Yet some of these contain valuable thoughts or facts scattered through their pages. A slow reader wastes a day finding this material, while rapid workers discover it by turning the leaves and reading pages at a glance. The writer often finds college seniors of high-class rank unable to skim a book and get its import. In some of these cases, at least, it is not slow comprehension, but rather lack of training. Like other forms of ability, this power to get meaning quickly, then to sift the information and to organize it rapidly into knowledge, improves with practice.

Despite every effort to remember, however, we still forget. It is therefore desirable to notice the rapidity with which forgetting proceeds. Investigations[1] have been made with children and adults, and the results are in substantial agreement. Ebbinghaus experimented upon himself with nonsense-syllables, and found that he forgot very

[1] C. H. Bean, *Archives of Psychology*, no. 21, 1912. Hermann Ebbinghaus, *Memory*, translated by H. A. Ruger, pp. 76 *ff*. E. O. Finkenbinder, *op. cit.* E. N. Henderson, *op. cit.* N. Magneff, *Die Bedingungen des dauernden Behaltens*, Zürich, 1905. E. Meumann, *The Psychology of Learning*, pp. 330 *ff*. G. E. Müller and F. Schumann, *op. cit.* Christo Pentschew, *op. cit.* P. R. Radossawlewitsch, *op. cit.* M. K. Smith, *American Journal of Psychology*, vol. 18, p. 504. Edward L. Thorndike, *op. cit.*

rapidly the first hour, proportionately less for the next seven hours, and still more slowly through the balance of the first twenty-four hours. "After a whole month fully one-fifth of the first work persisted in effect." Toward the latter part of the month the loss seemed so slight that Ebbinghaus was led "to predict that a complete vanishing of the effect of the first memorization of these series" [of nonsense-syllables] "would, if they had been left to themselves, have occurred only after an indefinitely long period of time." There is no essential difference between the findings of Ebbinghaus and later investigations. The chief disagreement is concerned with the rapidity of forgetting, immediately and soon after committing a selection to memory. Ebbinghaus' curve of forgetting appears to fall too rapidly at the outset.

Most of the tests of forgetting have been made on children or adults who learned either nonsense-syllables or selections with meaning just well enough to repeat them once without error. In the course of the investigations, however, the ability to recall was found to depend, among other things, upon the number of repetitions, upon the distribution of periods of work, and upon the number and nature of the associations formed. We accordingly turn to these memory-aids.

Repetition fixes memory. Experience shows this. If we wish to remember a name we repeat it. Investigation[1] of the effect of a number of repetitions have not only justified this conclusion from experience, but they have also contributed several other significant facts.

First of all, during the repetitions the mind should be

[1] A. Binet et V. Henri, *op. cit.* Hermann Ebbinghaus, *Memory*, pp. 52 *ff.*; *Grundzüge der Psychologie*, third edition, vol. 1, pp. 652 *ff.* P. Ephrussi, *op. cit.* E. A. Kirkpatrick and Abbie F. Munn, *Archives of Psychology*, no. 12, p. 36. Otto Lipmann, *Zeitschrift f. Psychologie*, vol. 35, p. 195. Max Offner, *Das Gedächtnis*, Berlin, 1909, pp. 47 *ff.* Adolf Pohlmann, *op. cit.*, pp. 65 *ff.* Fritz Reuther, Wundt's *Psychologische Studien*, vol. 1, p. 4. W. G. Smith, *Psychological Review*, vol. 3, p. 21. F. Weber, *Zeitschrift f. experimentelle Pädagogik*, vol. 8, p. 1.

actively attentive. It has been found that a combination of reading and repeating gives the best results for memory. Repeating aloud requires more effort and concentrates the attention better than silent reading. The latter is more likely to be passive. Experiments have shown, also, that memory is more than 50 per cent better if the learner is informed that the effect of the repetition will be tested than when he assumes that there will be no test.

Then, again, all repetitions are not of equal value in fixing impressions and ideas. To be sure, Ebbinghaus found that fewer repetitions were required to relearn a series of nonsense-syllables after twenty-four hours when the original number of repetitions was greater. And this saving was proportional, in a general way, to the added repetitions during the first learning, provided they did not exceed a certain number, not very accurately defined. More careful measurement of the relative efficiency of successive repetitions, however, has proved that the earlier repetitions have the greatest fixing power. This seems to be specially true in immediate memory—memory tested as soon as the learning is completed. Again, when the repetitions greatly exceed the number necessary for the first correct reproduction their efficiency gradually lessens until the gain becomes hardly measurable. Finally, it was observed that the value of repetitions varied with their distribution. This is of special importance not merely for students but also for those in the larger outside world of business and professional life. One or two questions will clear the ground.

Is it better to commit a selection of prose or poetry to memory at a single sitting, or is it advantageous to distribute our efforts over several days? Which plan brings the desired result with the least expenditure of energy? Quite a number of investigations[1] have been made and

[1] J. Larguire des Bancels, *L'Année psychologique*, vol. 8, p. 185. C. H. Bean, *op. cit.* M. Browning, D. E. Brown, and M. F. Washburn, *American*

there is general agreement that a distribution of periods of study gives the best results.

Ebbinghaus found, in committing nonsense-syllables to memory, that thirty-eight repetitions distributed over three days produced the same results as sixty-eight repetitions at a single sitting. Starch experimented with forty-two students. They were divided into four groups, one of which worked ten minutes at a time twice a day for six days; the second group twenty minutes at a time once a day for six days; the third worked forty minutes every other day for six days; the fourth did the entire task at one sitting of two hours. The results showed a great advantage for the shorter, more widely distributed periods. The two-hour period of work at one sitting was a bad fourth. The advantageous periods of work in this experiment seem short, but the occupation consisted in associating numbers with letters, a task which would quickly cause fatigue.

Jost carried these experiments much further than any of the other investigators and proved that neither fatigue nor inattention explains the advantage of this distribution of time. Having eliminated these two factors, he undertook to determine the best arrangement of periods of work, and he found that twenty-four repetitions, distributed over twelve days with two repetitions a day, gave better results than less distributed periods. He inclines to an even more extended distribution. If we accept Jost's view, that the

Journal of Psychology, vol. 24, p. 580. Hermann Ebbinghaus, *Memory*, p. 89; *Grundzüge der Psychologie*, third edition, vol. 1, pp. 657 *ff.* John Bigham, *Psychological Review*, vol. 1, p. 453. Alfred Binet, *L'Année psychologique*, vol. 10, p. 116. W. F. Dearborn, *Journal of Educational Psychology*, vol. 1, p. 273. Adolf Jost, *Zeitschrift f. Psychologie*, vol. 14, p. 436. E. A. Kirkpatrick and Abbie F. Munn, *op. cit.* J. H. Leuba and Winnefred Hyde, *Psychological Review*, vol. 12, p. 351. O. Lipmann, *op. cit.* E. Meumann, *Psychology of Learning*, pp. 265 *ff.* G. E. Müller and A. Pilzecker, *op. cit.* Max Offner, *op. cit.* Nellie L. Perkins, *British Journal of Psychology*, vol. 7, p. 253. Adolf Pohlmann, *op. cit.*, pp. 82 *ff.* Fritz Reuther, *op. cit.* D. Starch, *op. cit.*

advantage of distributed practice and study[1] lies in the greater effectiveness of old associates, Miss Perkins' results[2] "indicate that this process of consolidation continues for at least forty-eight hours, and still longer if four or more readings are made on each day" [of practice]. Putting these investigations into general terms, the experiments show conclusively that an extensive distribution of study periods for a given piece of work is advantageous both for rapidity of learning and for permanent retention. The period favorable for one sitting and the length of intervening time will depend, among other things, upon the nature of the material and the difficulty of the task, with its accompanying fatigue. The economy of distributed study, instead of finishing what one is engaged upon and then dropping it, may then be considered established.

Jost next sought to determine why it is more advantageous to spread study or practice over several days instead of finishing the work at one sitting. He came to the conclusion that older associations—those which were established earlier—are more easily renewed than the more recent ones. This explanation, however, still leaves the question Why? unanswered. Some find the explanation in the effect of activity upon the nutrition of the organ exercised,[3] and in the dropping out of interfering associations. This would be a satisfactory explanation were considerable practice always involved. But the same advantage of distributed study is observed when the selection is read but once each time. A "setting" or "fixing" of associations, on the other hand, apparently satisfies conditions. Those that are older have had more time in which to become "fixed." Since it is difficult to understand in what this "fixing" consists, unless it be the result of cere-

[1] Jost experimented only upon learning and relearning, *i. e.*, memory.

[2] *Op. cit.*

[3] *Physiological Psychology*, by G. T. Ladd and R. S. Woodworth, p. 581.

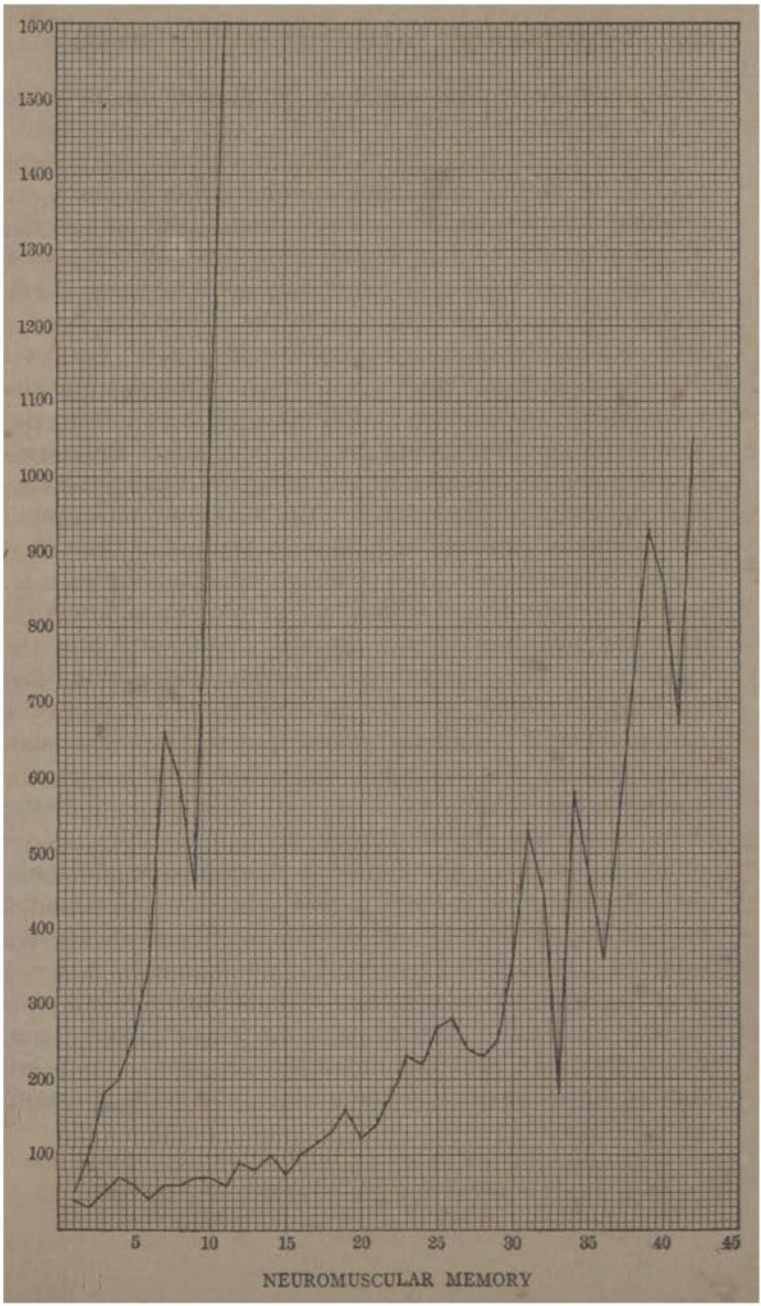
bral nervous activity, we seem at present compelled to take this view.

This explanation of the "setting" of associations during periods of rest is also indicated by experiments in relearning skilful acts after a long interval without practice. The writer at one time acquired considerable proficiency in tossing two balls with one hand, one ball being caught and thrown while the other was in the air. More than six years later he again tested himself in this feat. In eleven days he greatly exceeded the skill which he had acquired six years before after forty-two days of arduous practice. The following curves show the progress during the original learning process, and during the test in relearning the same feat six years or more later. The curve of relearning is on the left. The rate of progress is shown at the left of the perpendiculars, and the days required in each case are indicated under the base line.[1] The practice in which the skill was first gained was finished six years before this memory test was made. After the conclusion of the first investigation there were five monthly tests of the effect of intermission of practice, and one memory test two years later. With these exceptions there had been no practice during the six years.

The writer has also determined the effect of intermission of practice on the typewriter.[2] In this instance, the memory test was made more than two years after the close of the first experiments by which a certain degree of skill was attained. During the intervening two years he had not used any style of typewriter. The original investigation covered a period of fifty days, while in the memory test, two years later, only eleven days were required to reach the degree of proficiency with which the original investigation closed.

[1] This curve is reproduced from the *Psychological Bulletin*, vol. 7, p. 17.

[2] *Psychological Bulletin*, vol. 3, p. 185.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NEUROMUSCULAR MEMORY

The remarkably short time needed in both of these investigations to regain the former skill, after the long interval without practice, shows the persistence of neuromuscular memory. A still more significant fact, however, is disclosed by the curves for ball-tossing given above. It will be observed that in eleven days, after six years of cessation of practice, the experimenter acquired much greater skill than that with which he closed his experiments of forty-two days, six years earlier.

It is clear that the effects of activity upon the nutrition of the organ exercised and the dropping out of interfering associations do not account for the persistence and rapid improvement of skill after such long periods of inactivity. The astonishingly rapid gain in skill in ball-tossing beyond that originally acquired indicates not only a "fixing" of nervous and muscular associations, but also, during the long interval, some sort of integrative nervous activity by which the skill was further improved. At present there is no other tenable explanation. Batson, in his investigation,[1] also observed improvement in skill during intervals of no practice. "After a long rest period," he says, "the subject is found to be in a condition to improve very rapidly. In some cases the results show that they have actually gained power during the rest period."

The matter of "rest periods" has wide application. Jost's investigations, as well as the others to which reference has just been made, emphasize the value of repetitions, but always with an interval between them. A book, a legal opinion, an investigation in medicine or in science, which one wishes to remember, should be read again, but not at once. It is always important, however, that the meaning be as clear as possible in the first reading, because that gives the memory a freer field; and, when it is a matter of elaboration rather than of memory alone, the reconstruction of the thoughts, as a result of cerebral proc-

[1] *Op. cit.*

esses, has a better start. Error may be corrected, but mere confusion is rarely if ever clarified without further study.

These investigations also make conscious and thoughtful a method which has been followed instinctively, or, at any rate, unconsciously. Children who "go over" the lesson just before class are acting upon this principle of distributed study. To older persons, a book, or chapter, may seem quite unintelligible when read for the first time. Upon second reading, however, after the lapse of a day or two, it is often amazing how clear the misty statements become. One now sees meaning in what before was unintelligible. Had the reader stopped with the first reading nothing would have been remembered, but now the confusion takes an orderly form. Something is indicated, however, in addition to reinforcement of memory impressions. Deepening impressions by repetition might account for the greater clearness, but this is hardly sufficient to explain the increased significance that a second reading produces after an interval of a day or so. And an intervening day gives better results than an immediate rereading. It seems to be another illustration of the integrative nervous activity to which reference has just been made.

As a practical deduction from these investigations and observations, it may be said that students would save time and effort by keeping at least one day ahead in their studies; and the last reading, like the earlier ones, should be as rapid as following the thought permits. "Cramming" is clearly unpsychological; for accumulated repetitions within a short time have only a temporary effect. That which is learned in this way vanishes quickly.

One reason for the meagre results of cramming is that association of ideas is reduced to their sequence in the text. The wider meanings do not have a chance to assert themselves. The bearing of associations upon memory may,

perhaps, be best illustrated by comparing those at the two extremes of usefulness.

Associations may be strictly artificial and mechanical or they may be significant and interpretative. Memory systems offered for sale are of the first sort. One of these systems which has been long in the market teaches the purchaser to remember numbers by translating them into letters of words. Zero, for example, is represented by *s*, *z*, or *c* soft; 1 by *t*, *th*, or *d*. "All the other letters" [of the word] "are simply to fill up. Double letters in a word count only as one." *This* or *dizzy* would then stand for the number 10, and catch or gush for 76. "Now," continues the writer of the book from which we are quoting, "suppose you wish to memorize the fact that $1,000,000 in gold weighs 3,685 pounds. You go about it in this way:

"How much does $1,000,000 in gold weigh?

"Weigh—scales.

"Scales—statue of justice.

"Statue of justice, image of law.

"The process is simplicity itself" [*mirabile dictu!*]. "The thing you wish to recall, and that you fear to forget, is the weight. Consequently, you cement your chain of association to the idea which is most prominent in your mental question. What do you weigh with? Scales.

"What does the mental picture of scales suggest? The statue of justice, blindfolded and weighing out award and punishment to man. Finally, what is this statue of justice but the image of law? and the words *image of law* translated back from the significant letters *m*, *g* soft, *f*, and *l*, give you 3 – 6 – 8 – 5, the number of pounds in $1,000,000 in gold."

Another of these mechanical memory systems is based upon visualization. "We must not impress upon the memory mere words, but turn our attention and train our minds to see the objects or ideas they represent, associated or combined in mental pictures," the writer of this system

says. A list of a hundred "code" or "index" words is given, of which hat and hen are the first two. "See the hat and the hen in the picture together," we are told. "Do not see a hen of ordinary size, but use one strengthening principle of imagination, that of exaggeration. See a large hen four feet high. Put the black silk hat on the hen's head; now put motion into the picture, and see the hen strut about. . . . Knowing our index words will enable us to remember a number of varied items, such as errands." Suppose, now, that we wish to buy stamps. "We may form a picture of a large hat decorated with postage-stamps, or any clear combination of stamps and hat. The more conspicuous and striking the picture, the easier will it be to recall it." But there are also other associations in this system. "Trustees is similar in sound to rusty, so if we make trustees suggest rusty, and visualize a rusty can, the gap is bridged. . . ." Letters are to stand for figures, but it all goes back to visualization of the objects represented by the "code" words. "A combination picture of a mop and a chair will represent 3964. The danger of transposing figures, by recalling the picture as chair—mop 6439, instead of 3964, can be avoided by having the first object much larger than the second. In the case of 3964, picture the mop larger than the chair."

Of course there is no fault to find with any of this except with the whole of it. Its associative machinery is so crude that the rattle is distressing. Yet these systems are fairly representative of those on sale. That they continue and multiply indicates buyers. Consequently, some of the purchasers must feel that they receive value for the price. The explanation seems to be that if a man is sufficiently interested in improving his memory to pay an exorbitant price for a "system" he will continually keep the thought of remembering in mind. He will also observe details and repeat what he wishes to remember as he never did before the expenditure made it worth while.

The basis of a good memory is to discover valid relations, such as those of time, place, similarity and dissimilarity, cause and effect. A student may learn a mathematical or chemical formula as he would learn a series of nonsense-syllables, but he will forget it after twenty-four hours. If, however, he learns to work out the formula he will remember it. In the same way a lawyer may study court decisions as isolated facts, without reference to their causes, and he will not remember them long beyond the trial of his case. But if he study the earlier decisions out of which they grew, he will become an authority in legal matters.

The value of associations with meaning is emphasized by the results of the grotesque memory systems from which we have quoted. They show that if one works hard enough on any system of association, however mechanical and meaningless it may be, one will obtain observable results. Naturally, after paying twenty-five dollars for lessons the purchaser works at the system so as to get the value of his money. If he would be half as diligent with real relations between ideas as he is with these artificial ones, his memory would be marvellous. It should not be forgotten, however, that memory is not just one mental, or rather physiological, process which can be put through a course of training and afterward be good for all kinds of material. We have memories, not a memory. In other words, men and women have a good memory for certain kinds of facts, and a poor memory for others. A woman, for example, may be able to recall the dishes served at a score of dinners to which she was invited, yet be unable to remember any historical facts that she has read. We may, however, improve our ability to recall in certain lines by practice in those lines, but the common belief that the memory, in general, may be trained is erroneous.

The secret of memory is to think about what one wishes to remember—to think it, as we have said, in connection

with other facts with which it has a spatial, temporal, causal, or other relation that gives it meaning and interprets it. Thinking presupposes a question or problem which one wishes to understand. Organization of knowledge is essential, and this organization proceeds with reference to the successive phases of the problem upon which one is working. Facts are classified under general principles which in turn explain or lead to the interpretation of the question under consideration. Information that is referred to principles is easily remembered. Darwin has told us how organization and classification of knowledge attained results with himself. His retrospect also shows the value of rethinking what has been read that memories not at first available may have a chance to assert themselves. "I have no quickness of apprehension or wit which is so remarkable in some clever men, for instance in Huxley," he says in his *Autobiography*. "I am, therefore, a poor critic: a paper or book, when first read, generally excites my admiration, and it is only after considerable reflection that I perceive the weak points."

No investigations bearing directly upon the value of relations with meaning, such as cause and effect, have been made, but we know that memory depends upon association, and that the more "sense" or "meaning" one sees in what one is reading the longer it will be retained. Experiments[1] have shown that prose and poetry can be learned with vastly greater ease than an equal number of disconnected words, and that it will be remembered much longer. This, of course, puts the matter very inadequately.

[1] J. H. Bair, *Psychological Review Monograph Supplement*, no. 19, 1902. J. A. Bergström, *American Journal of Psychology*, vol. 5, p. 356; vol. 6, p. 433. A. Binet and V. Henri, *op. cit.* W. F. Book, *University of Montana Bulletin*, no. 53. Mary W. Calkins, *Psychological Review Monograph Supplement*, no. 2, 1896. Hermann Ebbinghaus, *Memory; Grundzüge der Psychologie*, third edition, vol. 1, p. 685 *ff.* Hugo Münsterberg, *Beiträge zur experimentelle Psychologie*, vol. 4, p. 69. G. E. Müller and A. Pilzecker, *op. cit.* W. L. Smith, *American Journal of Psychology*, vol. 7, p. 436.

An entire chapter, or more, can be read in a short time, and the substance repeated on the following day. To commit this to memory *verbatim* would require many hours.

One of the noticeable causes of memory obstruction is interfering associations. It is in the early stages of learning, however, that this interference is especially likely to produce confusion. This has been observed both in acts of muscular skill and in mental activities. When, on the other hand, proficiency in one thing has been attained, a new kind of work with opposing responses may be undertaken without observable interference. For example, one may learn to write with equal skill on two typewriters with different keyboards provided one becomes an expert with the first before starting to use the second. The significance of this in the acquisition of knowledge is obvious. A solid foundation must underlie the superstructure. Declensions, conjugations, and idiomatic constructions of one foreign language should be made automatic before beginning a second. In science and history one point of view should be thoroughly mastered before passing to other opinions and criticisms. This, of course, makes the selection of the first book to be read or studied a matter of supreme importance, because it is to be the base of operations from which the reader goes out to survey the terrain, and decide upon his strategic movements. Until he has acquired sufficient knowledge and skill to live upon the country he must constantly return to his base for supplies. Consequently, it is important that he be substantially provisioned with the fundamental necessities as an aid to memory.

Economy in memory has many points of approach, so we turn now to the manner of committing prose or poetry to memory. Is it better to read the entire selection through until it is learned, or is the work done more quickly by committing limited portions, and then combining them? This is an important question for public speakers. The

investigations[1] are quite decisive. In learning connected discourse of any sort, or lists of words, the economical method is to read the whole through from beginning to end until everything is memorized. The "whole" method requires fewer repetitions and less time than the "part" method. But more important than the saving of time and labor is the better retention. What is learned by the "whole" method is remembered longer and reproduced more accurately. This is true of both adults and children.

Miss Steffens found that individuals differ widely as to the manner of distributing their repetitions over the selection, but all divide it into sections with undue attention to the first part. Children especially waste time upon the first few lines by continued repetitions, and neglect the latter part. The chief reason for this practice of both adults and children is probably that learning in sections produces immediately noticeable progress while the "whole" method requires more time for the result to be observable. In addition, the human disinclination to move on—to attempt the new and strange—causes the learner to keep repeating the first part, and when he has started ahead to return again to the first few lines.

Meumann's experiments show that the time and repetitions required for memorizing a selection increase with the number of parts into which it is divided. This is true of nonsense-syllables and material with meaning. But it is more noticeable in the latter case. And the advantage of the "whole" method is greater as the amount of the material to be learned increases. Of course, since recall is the object, the final question is, Which method produces the firmest retention and the most accurate reproduc-

[1] J. Larguire des Bancels, *op. cit.* Ernst Ebert and E. Meumann, *Archiv. f. d. gesamte Psychologie*, vol. 4, p. 1. Hermann Ebbinghaus, *Memory; Grundzüge d. Psychologie*, third edition, vol. 1, pp. 669 *ff.* P. Ephrussi, *op. cit.* E. Meumann, *Psychology of Learning*, pp. 233 *ff.* Günter Neumann, *Die experimentelle Pädagogik*, vol. 4, pp. 63, 155. Max Offner, *op. cit.*, p. 61 *ff.* Christo Pentschew, *op. cit.* Lottie Steffens, *op. cit.*

tion? And in these respects the "whole" method again excels.

One of the objections to learning prose or poetry by sections is that interfering associations are established. Breaks between the sections must be connected. The end of a section is associated with its beginning instead of with the first few words of the following lines. These associations impede continuous reproduction, and time and effort must be expended in suppressing them. In the "whole" method the learning is equally distributed and the entire selection is learned uniformly. By this method, also, associations are formed between the parts, however far they may be separated. Not merely the contiguous portions, but also those remote from one another are influenced by associative bonds, so that it is not merely one word or line that recalls the next, but rather the unity of all that precedes and follows; for associations work in both directions, backward and forward. Opinions expressed on one topic by several persons, for example, tend to be recalled because of their numerous connections, but conversations with different persons on varying subjects do not recall one another, even though one immediately follows the other.

We have been considering economical memory methods, but there is another closely related question, and that is, Does the difficulty of memorizing increase proportionately with added quantities of material? Ebbinghaus[1] concluded from his experiments with nonsense-syllables that the number of repetitions necessary for memorizing increases with enormous rapidity as the number of syllables increases. Later investigations,[2] however, have shown that this is not altogether correct. The larger the quantity to be learned the relatively fewer repetitions are

[1] *Memory*, pp. 46 *ff.*

[2] C. Knors, *Archiv. f. d. gesamte Psychologie*, vol. 17, p. 297. E. Meumann, *Psychology of Learning*, pp. 275 *ff.* F. Weber, *Zeitschrift f. experimentelle Pädagogik*, vol. 8, p. 1.

needed to memorize it. In other words, as one of the investigators puts it: "Our ability to memorize increases with the demands made upon it." One explanation of this fitting of memory to its task is probably the general tendency to adjustment. Man, as we have seen, fits his efforts to the demands—to the obstacles, to the resistance. He does not do it consciously. It is a sort of organic adaptation. Without the pressure of resistance, without something to overcome, relaxation sets in. If one's abilities are to be tested it must be through a bigger job, one that calls for the best that can be given. Then, if the man has adequate reserve power he uses it because the result is worth the effort, and it can be gained in no other way. And in memory, as in other matters, men reveal their power only in response to pressure from without.

In committing to memory a short selection one does not feel that much effort is required. With a larger amount, on the other hand, the desire to save time leads to immediate and persistent concentration of attention. The period of "warming up"—overcoming the initial disinclination—is shortened or eliminated, and the associations are strengthened. In this way the work is accomplished in a proportionately shorter time.

A survey of memory from the vantage-ground of its strength and weakness brings into view certain facts and principles. First of all, adults can no longer accuse their age for their memory failures. The mature can remember better than children if they have more knowledge—and use it. Unwillingness to recall related knowledge and to make the application cause many lapses of memory. We should, however, not try to remember everything. Not a few memory troubles begin here. Individuals make little or no distinction between memory values. Consequently, there is no mental emphasis, no outstanding facts and principles to which special attention is given and around which related matter is grouped.

We have said that much of the information which we expect to use can be readily found in books of reference. Dates, figures, statistics, and many details are matters of this sort. Engagements are of only temporary moment, and should be written down. The memory should not be needlessly encumbered. Historical information should be grouped by landmarks, for which comparatively few dates are needed. In science, conclusions and principles should be remembered. They are few, and facts are many. So their retention is not difficult; and besides, principles will usually carry with them essential details.

After material has been selected as worthy of a place in memory, the next move is to understand it. If it is historical, scientific, or literary interpretation, its comprehension will require special attention, and thinking guarantees retention. But understanding has a wider reach than is usually attributed to it. There must be reasons for the conclusions and interpretations, and these reasons involve relations with other facts—relations of cause and effect, of succession, contiguity, or similarity and contrast. These relations are interpreting connections with other ideas by which the thought that we wish to remember acquires meaning, and through this wider significance it is later recalled. Finding meaning is the basis of thinking, and thinking is fundamental to memory. Interfering associations are likely to occur and obstruct recall unless the thinking is accurate and clear.

Repetition, of course, should not be overlooked. Anything that is worth remembering deserves the effort that will fix it. But the repetitions should not occur at once. Intervals of a day or more should separate them, and then there should be no dallying. Surprise is often expressed at the ability of some men to remember humorous stories. The explanation, however, is that these people are inveterate story-tellers. Indeed, their stories have another humorous aspect, quite apart from their content, of which

the envied narrators are not conscious. The repeating habit is so fixed that they tell the stories several times to the same persons. Therein lies their success—and failure. Repetition fixes the stories, but no effort is made to remember those to whom they have already been related.

Memory, then, is not the capricious, freakish process that it is sometimes thought to be. It is subject to law and order. Some of its laws have been determined by the investigations to which we have referred. Associations—not artificial ones but those with meaning in them—we have found to be the compelling force through which ideas are recalled. The problem of memory therefore resolves itself into getting the right associations and "fixing" them. It is with the "fixing" process that the investigations contained in this chapter deal. In selections to be committed to memory the associations are given in the text. Here, the "whole method," with as rapid reading as clear comprehension permits, should be the plan. When, however, one reads, and tries to get the import, associations reach out further and include all related thoughts. In this case, getting the full meaning with all its implications and organizing the knowledge thus obtained are the foundation for remembering. But here, also, repetition should not be neglected, and in repeating new meaning will be discovered.

Although the impressionability and retentiveness of nerve-cells probably cannot be improved directly, indirectly they may be influenced by severe attention to what has been selected for retention. Training counts for much, and also knowledge of one's personal memory deficiency, with care for the methods of improvement. Darwin says of himself: "My memory is extensive, yet hazy: it suffices to make me cautious by vaguely telling me that I have observed or read something opposed to the conclusion which I am drawing, or, on the other hand, in favor of it; and after a time I can generally recollect where to search for

my authority. So poor in one sense is my memory that I have never been able to remember for more than a few days a single date or a line of poetry."[1] Montaigne also speaks of his poor memory, but neither with him nor with Darwin does the defect seem to have been a serious handicap in what they set themselves to accomplish. They organized their minds and work to retain the information they needed. And the more humble man with smaller tasks may do as well, if he will only apply the principles upon which a serviceable memory is built—and think.

[1] *Autobiography.*

CHAPTER VIII

THE PSYCHOLOGY OF TESTIMONY AND RUMOR

THE accuracy of reports of what has been seen or heard is a matter of wide interest. In courts of justice it decides the liberty or life of the defendant, and in the social world the narration of conversations or events often disrupts a community and destroys the happiness of all concerned. Assuming an earnest desire to relate the facts as they occurred, what are the chances for a truthful narration, and does the feeling of accuracy assure a reasonably correct reproduction? These questions are fundamental to court testimony and to social intercourse; and in the answers are revealed some interesting peculiarities of human psychology. Perhaps these questions may be best approached by a concrete case.

A few years ago the writer's attention was directed to a rather remarkable criminal trial. In 1871 Alexander Jester started east from Kansas in a light spring wagon with canvas top, drawn by two small pony horses. While fording a stream near Emporia, as the horses were drinking, he fell into conversation with Gilbert Gates, a young man who was returning from homesteading land in Kansas. Young Gates was travelling in what was then known as a prairie-schooner drawn by a pair of heavy horses. Jester had three young deer in his wagon, and Gates a buffalo calf. They decided to travel together and give exhibitions with their animals to meet expenses. When they reached Paris, Missouri, Gates had disappeared. Jester's explanation, at the preliminary hearing, was that he became homesick and sold his outfit to him that he might hasten

home by rail. Jester was seen leaving Paris driving Gates' heavy team with his own lighter team tied behind. Later he sold the heavy horses and various other articles known to have belonged to Gates, but which he claimed were purchased. It is not the purpose of the writer to decide the merits of the case, but rather to call attention to certain exceedingly interesting psychological features.

Jester was soon arrested but escaped, and was not brought to trial until 1901. Thirty years had therefore passed since the events concerning which witnesses were called upon to testify. Besides, there was a blinding snow-storm at the time when the crime was supposed to have been committed; and, of course, this would have interfered with accurate observation. Further, when the witnesses "saw" the things which they related they were not aware that a crime had been committed. Two preliminary questions thus suggest themselves: First, would any one note, as carefully as the subsequent testimony indicated, the peculiarities of a chance traveller on the road, especially in a blinding snow-storm, and at a time when no reason existed, so far as known, for unusual observation? Second, would observers, under these circumstances, be likely to remember, after the lapse of thirty years, the minute details of what they had seen? The incidents were of the unimportant, uninteresting sort that were frequently experienced at that time. Even the prairie-schooner could hardly have been exceptional enough to attract special attention, since, as will be seen later, one of the witnesses was taking his wedding-trip on horseback, with his wife behind him on the same horse. But let us turn to the testimony.

When the trial was held, two women described the size and color of all the horses, the harness of the heavy team, the figure and appearance of Jester—height, a little over six feet, weight about one hundred and eighty pounds, with a hook-nose, gray eyes, powerful physique, and large

hands. They further testified that, looking into the first wagon as it approached, they saw lying in the bottom the outlines of a human form with a buffalo-robe thrown over it; and they gave this testimony confidently, thirty years after the crime, notwithstanding they were twelve and fourteen years of age, respectively, when the events transpired, and though they were riding at a canter in the face of a heavy snow-storm, with veils tied over their faces, and the horses which they met were travelling at a fast trot when they passed in the storm. A farmer swore that the buffalo-robe was covered with blood, and still another witness that, while helping Jester start his wagon, the canvas blew back and he saw the body of a man with his throat cut. The description of the body was that of young Gates.

A man who had just been married, and was taking his wife behind him on his horse to their new home, described the horses attached to each wagon, the wagons, and the dog; and this in spite of the fact that his own horse was going at the "single foot" gait, that Jester's horses were trotting past, that it was snowing hard, and that, being on his honeymoon, other thoughts and interests would seem to be occupying his mind.

A man of thirty-six, who consequently was six years of age at the time of the crime, testified that later, during the thaw and heavy rains of spring, he and his father saw the body of a young man of eighteen or twenty years of age floating down the stream. He described the color of his hair and complexion, and said that he had on a blue-checked shirt and blue overalls. His description of the shirt agreed with that of Mrs. Gates of a shirt which she had made for her son. It is interesting to note, in this connection, that neither the father of the six-year-old boy nor the girls who saw the outlines of a human form in the wagon, nor the man who helped start Jester off, said anything about their observations until Gates' disappearance and Jester's arrest had been published.

It is quite evident that, whatever the merits of the case, the testimony of these witnesses, after a lapse of thirty years, was amazingly exact. Yet it would be unfair to assume that they were dishonest. All of those from whose testimony we have quoted were people of good standing in the community. They could be relied upon both in word and deed. The attorney for the defense,[1] to whom the writer is indebted for the facts in the case, speaks in the highest terms of these witnesses. "They were among the best people of Monroe County," he says. "They wanted to be truthful, and they were very friendly to me, entertaining me overnight when I was looking up evidence preparatory to the trial."

What then was the explanation of their remarkable exactness, even in the smallest and in some instances least noticeable and least interesting details? The key to the mystery lies in the way in which the case was worked up, in the publicity that it received, and in human psychology. After Jester's final arrest, Pinkerton detectives were employed and seven or eight leading criminal lawyers of Missouri and Chicago were engaged to assist the prosecution. The detectives, as they secured one fact after another, cultivated the information by suggestive questions and statements to those with whom they conversed. When, for example, a prospective witness said that there was a buffalo-robe in the wagon the detectives would ask if it covered the outlines of a human form. The man would think it likely, and soon that it did. Of course the case was featured in the county newspapers. It was a first-class news story. Pictures were published, pictures of Jester and Gates, pictures of the horses and wagons, pictures of the dog, and pictures of scenes in the chain of events leading to the alleged crime. The pictures were based on what witnesses said they saw, and what the detectives said they must have seen, and reportorial imag-

[1] Mr. Joseph S. McIntyre, a practising Saint Louis lawyer.

ination supplied whatever was lacking. The clothing of Gates was described, the articles he had with him enumerated, the facts to which certain witnesses would swear were told to other witnesses and reported in the newspapers. Indeed, all the events of the crime as it was conceived by witnesses, reporters, and detectives were portrayed and described with much the effect of a moving-picture representation, until fact and fiction were indistinguishable. It is a well-known principle of psychology that if you tell a man something often enough he finally accepts it; and as he continually repeats it, even as a possible fact, it ends by becoming firmly fixed. Then he believes that he saw or heard it.

We must not forget that all this happened thirty years after the events. The undetected vagueness of memory-details of the witnesses furnished a fertile soil for the growth of imaginary pictures. The attempt to see faces in the moon is comparable to their experience. With a dim outline, or a sketch with several possibilities, there is always a strong tendency to fill in the outlines, usually with what is in one's mind. As an illustration, ask a group of persons to indicate the kind of a figure six which is upon their watch-dial. They will be found to divide between VI and 6. A few, whose "memory" is more accurate than that of the others, recalling that the figures take their line of direction from the centre of the dial, will write the figures upside down. All, except those to whose attention the peculiarity has already been called, will "remember" seeing the figure. Yet, in watches with a second-hand there is no six.

Despite the best intentions of truthful people, there are many ways in which the memory may be disturbed without the individual being aware of the alteration; and a brief reference to some of the causes of these memory distortions will reveal the fickleness of this reproducer of past experiences. These alterations of memory have a bear-

ing upon reports of events given either as sworn testimony or in social intercourse, and all are intimately related to the psychology of the day's work.

One of the causes of unintentional perversion of memory is the constant talk that an exciting occurrence produces. There is always a tendency to say what we wish might have happened. This is especially true when we ourselves participated in the events. "The most frequent source of false memory," says James,[1] "is the accounts we give to others of our experiences. Such accounts we almost always make both more simple and more interesting than the truth. We quote what we should have said or done rather than what we really said or did; and in the first telling we may be fully aware of the distinction. But, ere long, the fiction expels the reality from memory and reigns in its stead alone." It is not necessary, however, that we be participants in the events. The tendency to enlarge upon a story is human. So strong is this inclination that if there is nothing unusual in the occurrence the story-teller transforms the common into the uncommon. This is especially true when the marvellous is involved. Man is saturated with the mysterious. James quotes a good illustration from Carpenter's *Hours of Work and Play*.

"It happened once to the writer to hear a most scrupulously conscientious friend narrate an incident of table-turning to which she appended an assurance that the table rapped when *nobody was within a yard of it*. The writer being confounded by this latter fact, the lady, though fully satisfied of the accuracy of her statement, promised to look at the note she had made ten years previously of the transaction. The note was examined, and was found to contain the distinct statement that the table rapped when *the hands of six persons rested upon it!* The lady's memory as to all other points proved to be strictly

[1] *Principles of Psychology*, vol. 1, pp. 373 *ff*.

correct; and in this point she had erred in entire good faith."

Closely related to the effect of much talking is the influence of much thinking. Long-continued pondering over details which one feels must have happened, and trying to recall whether they occurred or not, usually ends in their recollection. The reasons behind this are much the same as those that produce this result through much talking. We think of what we wish had happened, of possible interpretations of actions, and soon we are unable to distinguish between things that actually happened and our thoughts about what might have occurred. Our wishes, hopes, and sometimes fears, are the controlling factors. At times this takes a form that may be called retroactive memory. Knowing what we ought to have done on a given occasion we think the action into the memory series. Again, it may be a transposition of events. We may have performed the act, but not at the moment when we locate it in the chain of events. It may be, for example, that we examined the ground where an alleged crime occurred, but our examination was made before the hour of the crime; we, however, insert this act later in the memory series, *i. e.*, after the crime. This is especially noticeable in descriptions of occult phenomena where unusual care is needed to detect deception. Many times the slate has been cleaned by the sitter, and then allowed to pass into the hands of the medium. Afterward the cleaning is remembered as having been done just before the writing, and *the slate as not having left the sitter's hands.* In all cases "in which a man *frequently* thinks over his experiences, he is very apt to come in the end to seem to remember clearly things of which he was at first very doubtful; and his memory is likely to be wrong. This happens through a confusion of what he at first remembered and what he afterward often imagined. In other words, he forgets that he has only imagined a thing of which his

memory was not certain, and then remembers what he has imagined as if it were a real memory of an actual fact." [1] The old soldier with his wonderful tales of events in which he participated, but which never occurred as he relates them, though he is entirely oblivious of inaccuracies, is an illustration.

Gross, commenting upon this influence of the imagination, finds striking departures from the truth. We must not think, he says,[2] "that an honest witness will at all hazards stick to the truth. It is difficult to believe how far the imagination of emotional, though highly intellectual, persons will carry them. . . . One has only to note how easily emotional persons can be made to relate occurrences which they have never seen or heard, and that without any recourse to suggestion. In spite of their earnest desire to stick to the exact truth, on the first opportunity they strike off to the right or left, and at last can no longer distinguish between what they have really seen and what they have only imagined."

Moreover, a warm imagination often leads one to believe that events have been experienced when the only source of information concerning them is the narration of others. This of course subjects the "remembered" facts to all the inaccuracies of hearsay evidence. Boswell, referring to his first meeting with Johnson, gives an illustration[3] of this. "Mr. Murphy," he says, "in his *Essay on the Life and Genius of Dr. Johnson*, has given an account of this meeting considerably different from mine, I am persuaded without any consciousness of error. His memory, at the end of near thirty years, has undoubtedly deceived him, and he supposes himself to have been present at a scene which he has probably heard inaccurately described by others. In my note, *taken on the very day*, in which I

[1] F. Kuhlmann, *American Journal of Psychology*, vol. 16, pp. 305 *f*.
[2] *Criminal Investigation*, translated by John and J. L. Adam, pp. 77, 90.
[3] Boswell's *Life of Johnson*, edited by G. B. Hill, vol. 1, p. 453, note.

am confident I marked everything material that passed, no mention is made of this gentleman; and I am sure that I should not have omitted one so well known in the literary world. It may easily be imagined that this, my first interview with Doctor Johnson, with all its circumstances, made a strong impression on my mind, and would be registered with peculiar attention." Again, referring to Mrs. Piozzi's account of an incident and conversation between Doctor Johnson and himself, Boswell says:[1] "Mrs. Piozzi, in her *Anecdotes*, has given an erroneous account of this incident, as of many others. She pretends to relate it from recollection, as if she herself had been present; when the fact is that it was communicated to her by me. She has represented it as a personality, and the true point has escaped her."

Another cause of false memory is that the purpose to do something at the moment may later lead us to insert the act in its proper place in the series of events without our being aware that we did not do it. An illustration of this tendency has been related by Hodgson.[2] A Hindoo juggler was sitting upon the ground making wooden figures, and coins two feet from him dance around, leap from the ground and strike one another. An officer who was present "drew a coin from his pocket," Mr. Hodgson says, "and asked the juggler if this coin would also jump. The juggler replied in the affirmative, and the coin was then placed near the others on the ground, after which it displayed the same propensity to gymnastic feats as the juggler's own coin. Two or three other travellers were present at dinner in the evening of the same day, and in the course of the conversation the officer described the marvellous trick which he had witnessed in the afternoon. Referring to the movements of the coin, he said that he had taken a coin from his own pocket and placed it on the

[1] *Op. cit.*, vol. 2, p. 216, note.

[2] *Proceedings of the Society for Psychical Research*, vol. 4, p. 385.

ground himself, yet that this coin had indulged in the same freaks as the other coins. His wife ventured to suggest that the juggler had taken the coin and placed it on the ground, but the officer was emphatic in repeating his statement, and appealed to me for confirmation. He was, however, mistaken. I had watched the transaction with special curiosity, as I knew what was necessary for the performance of the trick. The officer had apparently intended to place the coin upon the ground himself, but as he was doing so, the juggler leaning forward, dexterously, and in a most unobtrusive manner, received the coin from the fingers of the officer as the latter was stooping down, and laid it close to the others. If the juggler had not thus taken the coin, but had allowed the officer himself to place it on the ground, the trick, as actually performed, would have been frustrated." Evidently, the officer's imagination of himself as placing the coin upon the ground suppressed and finally obliterated the impression made by the juggler's action in receiving the coin. We not only allow our attention to be distracted by actions which are or are not intended to produce the distraction, but we also forget that it has been distracted; and then we fill in the gap by some conjectured or imagined events which form a juncture with the contiguous portions of the memory series and from that time on they appear to be an integral part of our memory of what happened. These interpolations account for many of our distortions of facts.

To the preceding causes of defective observation and memory disturbance we must also add biased opinions. They almost invariably lead one to overlook details opposed to one's personal interests or convictions. This is a phase of the tendency to forget what one prefers not to believe, hopes is not true, or is in opposition to opinions which one holds and perhaps has already expressed. A person does not intentionally forget these things, but in some way they are repressed by the opposing ideas that

are more congenial. Reference has been made in an earlier chapter to Darwin's observation of this failing in himself, and in courts of justice the testimony of interested witnesses is subject to this defect. Long-continued thinking about matters which have a controlling personal interest, and trying to recall whether certain things happened, is likely to end in the recollection of the desired circumstances. Because interested witnesses are persuaded of the justice of their case they have dominating beliefs, and imagination readily supplies the evidence for their truthfulness. This mental attitude renders the testimony of believers in the "occult" valueless for "supernormal" exhibitions. "Events that under ordinary circumstances, or if the witnesses were intent upon discovering a trick, would make a comparatively deep and lasting impression upon consciousness, glide past or are swiftly forgotten, simply because of the absorption of the spectator's interest in the supposed 'supernormal' manifestations." Hodgson relates an incident which came under his own observation. "At a materialization séance given by Firman, at which I was present," he says, "a supposed 'spirit-form' appeared, draped in a semi-transparent flowing robe—so transparent, in fact, that Firman's bare arm was visible behind it, waving it to and fro. When the figure retired to the cabinet, the door closed upon a portion of the robe. The door opened again slightly, and the end of the robe was drawn into the cabinet. Most of the sitters perceived this clearly, but one, a 'believer,' averred conscientiously that the fabric was not withdrawn, and that he saw it slowly melt away." [1]

Bias naturally prepares the way for the influence of suggestion as a mental disturbance to any one giving testimony or "repeating" conversation. Every one is susceptible to this subtle force, but an acquiescent state of mind enables the effect to be produced more easily. Scores

[1] *Op. cit.*, pp. 389–390.

of people have seen the face of a departed sister, brother, wife, or husband in the same illuminated mask.[1] An expectant, confiding state of mind is all that is needed. Then deception is easy. Here is an illustration. A conjurer, posing as a medium, produced a slate communication from the sister of a sitter. It was a common slate, washed clean and placed "flat upon the table with a bit of pencil about the size of a pea underneath. We then joined hands," one of those present states, "and after the lapse of about ten minutes, under the full glare of gaslight, we could distinctly see the slate undulate, and hear the communication that was being written, a copy of which I herewith append: 'My dear Brother: You strive in vain to unlock the hidden mysteries of the future. No mortal has faculties to comprehend infinity. Charlotte.'" These lines "were not only characteristic of my beloved sister while in the form," the recipient said, "but the handwriting so clearly resembled hers that, to my mind, there cannot be a shadow of doubt as to its identity." And again, "a short communication from my mother, in her own handwriting," the same recipient insisted, "was found plainly written."[2] Since the "medium" frankly says that he wrote both messages with his own hand, the resemblance to the writing of his sister and mother must have been imagined by a submissive mind yielding to the suggestion that he would receive messages from them.

The suggestions in the Jester case were given by the questions of the detectives and reporters, as well as, more directly, by published pictures and newspaper stories, and by conversation in the country stores; for the case caused great excitement. It was widely and daily discussed. So ideas were planted in the minds of those to be called to

[1] Instances can be found in various books which reveal the methods of "mediums," as D. P. Abbott's *Behind the Scenes with the Mediums*, or Hereward Carrington's *Physical Phenomena of Spiritualism*.

[2] S. J. Davey, *Proceedings of the Society for Psychical Research*, vol. 4, p. 405.

the stand, and when planted they grew. Lord Bacon, with that keen insight into human nature that he always showed, once said: "It is a good point of cunning for a man to shape the answer he would have in his own words and propositions; for it makes the other party stick the less." [1] Kuhlmann, drawing on a number of investigations, enforces this view. "Memory illusion," he says, "is greater when statements made are answers to particular questions, than when the statements are made spontaneously on the part of the subjects without special questioning . . . questions are always more or less suggestive in the first place, and they may as frequently suggest the wrong thing as they do the right." [2]

Experiments have proved that, in general, when the average man reports events or conversations from memory and conscientiously believes that he is telling the truth, about one-fourth of his statements are incorrect; "and this tendency to false memory is the greater the longer the time since the original experience and the less carefully one has observed." It should be remembered in comparing the results obtained by the experimental method that in most of the laboratory tests the subjects know that an investigation of observation and memory is being made. Consequently, they are more observant, and for this reason the results are more favorable to memory than in matters of every-day life when events come suddenly and unexpectedly upon the observers and when, so far as they are aware, they will never be called upon to make a deposition regarding what they see or hear. In the laboratory, also, the subjects are on their guard against such extraneous influences as suggestion; and this, again, is not the case with what they see or hear on the street or in social intercourse.

Further evidence of the influence of suggestion is ob-

[1] *Essays:* "Of Cunning."

[2] *American Journal of Psychology*, vol. 16, pp. 395 *f.*

tained from the study of reports of different witnesses to a series of events, as, for example, a so-called spiritualistic séance. Whenever separate accounts of the same sitting are written by the different observers, without communication of any kind from the beginning of the séance till the reports have been finished, the witnesses are never in agreement even regarding critical matters.[1] When, however, the report is written by one of the observers and then passed to the others for criticism or approval, the account is usually indorsed as written, with few if any corrections. The inference from these two facts is strong that the "remembrances" of the co-signers of the account are greatly aided by the suggestions of the written report placed in their hands.

Another form of suggestion was recently reported to the writer by a physician. "My sister and I were standing at a street-corner one afternoon, waiting for a car," he said, "when suddenly a runaway horse and wagon came dashing by. The horse ran rapidly for a block, turned suddenly into another street, and then apparently stopped with a loud crash and shriek. We rushed to the corner to assist the injured. But to our amazement no horse or vehicle was in sight nor was there any evidence of a collision. We made inquiries and watched the newspapers but were unable to learn of any such accident. My sister and I are considered close observers, and we would have been willing to swear that the wagon was demolished and that some one was severely injured."

As will be recalled, we asked two preliminary questions regarding the value of some of the evidence given in the trial of Jester: First, would any one note, as carefully as the testimony indicated, the peculiarities of a chance traveller on the road, especially at a time when no reason existed, so far as known, for unusual observation? Second,

[1] A study of the accounts of the several witnesses of Davey's exhibitions, to which reference and citations have already been made, will show this. Reports of observers of other performances reveal the same disagreement.

would observers be likely to remember the details of what they had seen after the lapse of thirty years? These questions were asked with reference to a particular case, but the answers bear upon reports of events in general; and psychology replies definitely, No, to both questions. Indeed, as will be seen later, experiments discredit many positive statements made in reporting experiences or conversations even if the information is given shortly after the events occurred.

Interest and attention, to be sure, tend to fix facts and descriptions in memory. But persons are often called upon to give information regarding matters that attracted no special attention when they transpired, as in the Jester case. The keenest interest and closest attention, however, will not assure truthful accounts; for memory is exceedingly plastic and prone to error; and it is always exposed to the deflecting influences of repeated narration, with its generous mixture of error, continuous thinking about the affair with numerous fictitious insertions, intended actions not carried out, biased opinions, and suggestion.

Unreliable, however, as memory based on observation may be, second-hand accounts and those told or written some time after the events have occurred are still less dependable. Speaking of an abridged account of a séance, Hodgson says[1] that "a series of incidents which indicate, as I think, how the chief trick was performed, are entirely omitted; and writing, which according to the original report is described as having been obtained on an ordinary slate, is described in the later version as having been obtained between sealed double slates." Omission of things that actually happened, together with the substitution of events which did not occur, are evidently the rule in memory rather than the exception.[2] Social gossip, of course,

[1] *Op. cit.*, p. 399.

[2] For excellent examples, see article by S. J. Davey, in *Proceedings of the Society for Psychical Research*, vol. 4, p. 405, to which reference was made above.

prepares the stage for innumerable omissions and substitutions. Certain things are reported to have been said or to have occurred, and soon it is assumed that they happened. Then they become a part of the recollection.

As for the more general and fundamental question, Does the feeling of accuracy assure a reasonably correct reproduction, when an earnest desire to relate the facts as they occurred is assumed? the answer of psychology is equally definite: the feeling of accuracy is no proof of a correct reproduction. The omissions are forgotten; the substitutions, transpositions, and interpolations fit naturally into the memory series without mental disturbance. The honest narrator, or witness, feels that he is telling the truth, however far his statements may deviate from the facts; and it was so with the witnesses in the trial of Jester, though their stories were told and their testimony was given thirty years after the events which, when they were observed, did not have the element of interest needed to fix even the attention.

"I have every reason to think," says the attorney for the defense in the Jester case, "that all of the witnesses, even the man who was six years old when the events occurred and who described minutely the color of the shirt and overalls of the body floating down the stream, believed that they were testifying truly, and that they thought they actually saw all of the details which they related. I am convinced, however, that the general belief in the guilt of Jester, and the fact that the witnesses had talked over these details for many years, that they had been talked to by detectives, that they had been told the things to which others would swear, and that they had seen many pictures of the events, all produced such a psychological effect upon the witnesses that they confused what they remembered with the creations of imagination. This observation, I may say, has been verified by my subsequent experience in trial courts. I have seen many wit-

nesses who unquestionably thought they were telling the truth but who wholly failed to do so."

The fickleness of the memory of well-meaning witnesses which this attorney has observed in court trials is equally true of the reports of events, actions, and conversations in every-day life. Observation is unreliable. Actions are transposed, omitted, substituted, and inserted in the series of events observed. The mental attitude at the moment, personal bias, and suggestion are always exerting their influence; and reports of conversations are subject to the same inaccuracies. Statements are misunderstood, qualifying remarks pass unnoticed, views are perverted, opinions added, and much is forgotten. Then that which has been lost from memory is replaced by products of the imagination. The speaker is made to say what we think he should have said—what we would like to have had him say; and in this last, the personal attitude toward the one whom we are quoting, or toward the whole situation, is a large determining factor.

Unfortunately, abundant proof of the waywardness of memory has not altered the practice of trial courts. The attorneys for one side endeavor to nurse remembrances, and those opposed to confuse them. Honest witnesses are subjected to the same sort of cross-examination as is applied to those under suspicion. Suggestions, so far as court rules and decisions permit, are given, and every effort is made to confuse the memory instead of to assist it in recalling. Then the task of separating truth from error or falsehood is left to the jury, which is too often composed of men who are inexperienced in making distinctions and in drawing inferences. The writer is aware that, in American practice, obtaining and producing evidence is the duty of the parties' attorneys; the judge is merely to decide on its admissibility. Theoretically, the purpose of the trial is to lay the facts before the jury. Practically, however, the attorneys too often try to confuse the truth.

Their aim is to acquit or convict. It is sometimes said in praise of a criminal lawyer that he has secured more acquittals than any other lawyer. It would seem as if the time had come when it should be some one's duty to discover the truth rather than to obscure it—to promote justice rather than to win cases. Though in court practice success is striven for regardless of its consequences to others, judges in their decisions are taking some of the facts of psychology into account. A few quotations will show this.

Referring to errors of memory from some of the causes discussed under the Jester case, Mr. Justice Brown, giving the opinion of the United States Supreme Court, said: "Witnesses whose memories are prodded by the eagerness of interested parties to elicit testimony favorable to themselves are not usually to be depended upon for accurate information." [1] And again, another judge says that courts are "fully aware of the ease with which honest witnesses can persuade themselves that they remember some bygone circumstance which they are ingeniously induced to think that they remember." [2] And, once more, in evaluing memory after a long period of time, Justice Brown expressed the opinion that "after the lapse of twenty-five years it would, in the nature of things, be highly improbable that any witness who saw this fence for the single day it was exhibited would be able to describe it accurately." [3] Mr. Justice Swayne, thinking also of the element of time, said: "The confidence of the attacking witnesses is often in proportion to the distance in time that one is removed from the other. Their imaginations are wrought upon by the influences to which their minds are subjected, and beguile their memory." [4]

Judge Choate, referring to the effect of much thinking and of the imagination, expressed the opinion that "the

[1] 143, *U. S. Rep.*, 275, 284. [2] 33, *Fed. Rep.*, 922, 924, per Shipman.
[3] 143, *U. S. Rep.*, 275, 289.
[4] Quoted in *Hawes v. Antisdel*, 2 *B and A. Pat. Cas.*, 10, 22.

effort of the memory often supplies circumstances harmonious with the general impression of a fact or event, but which are supplied only by the imagination and the association of ideas."[1] And, again, Mr. Justice Field, speaking of the influence of much conversation about a case, says: "Some, from defective recollection, will blend what they themselves saw or heard with what they have received from the narration of others."[2] And still another judge gives the result of his experience with witnesses quite as definitely when he says that "things are told to persons till they verily believe that they witnessed them; and we repeat events until we are ready to swear, in the utmost sincerity, that we were spectators of their occurrence."[3] When a matter becomes serious enough to be a persistent subject of conversation it assumes an importance in the minds of those who were present which it did not possess originally. Observers then become possible witnesses, and as they think about it and talk it over, they imagine that they gave it closer observation than was the case.

That we do not observe events and the persons engaged in them as accurately as is commonly supposed is often proved in matters of every-day life; yet people continue to have perfect confidence in what they "see." Now, if we can determine, approximately, the residue of fact left in the memory after an experience, we shall be able to strike a balance between truth and fiction, between what may be expected from the memory and that which is the product of the imagination stimulated by suggestion and the other mental excitants that have been mentioned. With this purpose in view the following scene was enacted before a small class in psychology.

The regular work of the class was in progress, one of the young women being engaged in making a report on an investigation which she had made. The instructor in charge

[1] 4, *Fed. Rep.*, 730, 741.
[2] 4, *U. S. Rep.*, 42, 52.
[3] *Miller v. Cotten*, 5 *Ga.*, 341, 349.

—the writer—was sitting with the class. Since this is his custom when his students give reports, it caused no expectation of anything unusual. The only member of the class who was aware that anything out of the ordinary was to happen was the young woman who was to give the report. It was feared that an unexpected, violent interruption of her paper might give too serious a nervous shock, so she was informed just before she began to read that there would be a sudden interruption and that she should not be disturbed by it.

A few moments after the beginning of the report an altercation was heard in the corridor, then the door burst open and four students, two young men and two young women, dashed into the room. Miss R., immediately after entering, dropped a brown-paper package on the floor. This package contained a brick so that the occurrence might not be too inconspicuous. K. flourished a large yellow banana as though it were a pistol, and all struggled across the room to the side opposite the door, where the writer was sitting among several members of the class. He stood up at once, protesting at the interruption, and as he arose he threw a small torpedo on the floor. It exploded with the intonation usual with these children's Fourth of July torpedoes. H. fell back, crying, "I'm shot," and was caught by Miss R. All then hurried out the open door, Miss T. picking up the brown-paper package which had been dropped near the door by Miss R. The entire scene occupied less than thirty seconds and it was startling to the class, all of whom jumped up and crowded back against the wall, believing that it was a real riot.

Some of the "witnesses," especially the young women, were in such a state of fright that it seemed a wise precaution to reassure them with the information that the scene was "made to order." This assurance cut out at once the element of reality. But it also produced a condition of

comparative mental calmness, enabled the observers to review the events more clearly, and weakened the force of the one or two suggestions offered by the scene. This adds greatly to the significance of the meagre observations.

The effect of the announcement was at once observable. Those who had crowded back to escape the "danger" breathed again, and returned to their seats. Blank-books were immediately distributed and the members of the class were asked to write down what they had seen. Care was taken not to make any suggestions, but definite instructions were given to name the participants and to describe their clothing as accurately as possible. Three of those who burst into the room were members of the class, and since the class was small—there were twenty-nine students in it—they were well known to their associates. The third, Miss R., was not a member of the class but she was a senior, prominent in college activities, and all of the class knew her. To avoid uncertainty regarding this the observers were asked, after they had finished writing, whether the names and faces of any of the participants were unfamiliar to them and they all said that they were not. None of those who took part were in any way disguised and the brief scene was enacted in full view of the spectators, since they were seated in an irregular circle, as was usual with that class, and the events occurred within the circle. Let us now see what was observed with sufficient accuracy to enable the "witnesses" to record the information at once.

If the reader will turn to the "scene" it will be noticed that only a few things were done and that these few things were quite definite and conspicuous. The "play" was not overloaded. Four persons burst into the room. This number was not so large as to be confusing. They were readily discernible. Then there were two men and two women. It is doubtful whether an arrangement of persons could be planned more suitable for easy observation. Yet

of the twenty-nine "witnesses," only three knew that four persons dashed into the room. These three also realized that two were young men and two were women. To the others it was an indefinite number, to a few less than four, but to the majority more; some characterized them as "a crowd" or "a mob." That only three actually observed the number was conclusively shown again when they tried to name and describe the participants. In doing this the "witnesses" were forced to face the question of numbers. It should be emphasized that the "witnesses" were definitely asked to name and describe the actors. This is important because, in this respect, narration was supplemented by what was essentially interrogation, though without suggestion. Failures and omissions were therefore quite clearly due to inability to comply rather than to inadvertence.

Though the four participants were well known to the class and no disguises were used, no one recognized all of them. The result so far as concerns recognition by the twenty-nine "witnesses" is the following:

7 recognized 3.
11 recognized 2.
7 recognized 1.
4 recognized 0.

Surprising as these figures may seem to those who think that, even under excitement, they could recognize an acquaintance whom they had seen at least three times a week for eight months, the results are nevertheless too favorable to observation and memory, for recognition by elimination of those present played its rôle. This could not well be avoided without taking chances of having the participants unknown to members of the class. It seemed the better plan, therefore, to select the actors chiefly from the class, but this left three vacant chairs, and probably some of the "witnesses" unintentionally noted the absen-

tees though they were requested to rely wholly upon memory. The writer is of the opinion, however, that the observers tried honestly to conform to instructions, since by this time they were greatly interested in the experiment.

Now, as to mistaken identity. Eight "saw" persons who not only took no part in the performance, but who were either not present or who sat at a distance from the place where the scene was staged. Of these eight, three "saw" a member of the class who sat in the second row of the circle; one, a former member of the class who had withdrawn about three months earlier; a young woman who had never been in the class and was not present was "seen" by two; still another young woman, likewise not a member of the class and not present, by one, and, again, a member of the class who sat at a distance from the scene, by one.

The descriptions of clothing were so general as to be worthless for purposes of identification. Only thirteen of the twenty-nine attempted any sort of description even of those whom they recognized. All except one of these were women. Some "described" only one, and others two or three. The largest number of descriptions of any one actor was eleven. H., the object of these descriptions, wore a dark-blue suit, but none of the eleven made that distinction. They said either "dark suit" or "blue suit," with the exception of one who gave "bluish gray," the color of another suit that H. had occasionally worn. Only two noticed a conspicuous red tie, and one "saw" that his shoes were muddy and his face dirty, neither of which statements was true. As a matter of fact, he is one of those young men who are always neat, and who never have an article of dress out of order, and on this day his shoes were polished as usual.

The next largest number of descriptions of any one of the actors was six. These descriptions referred to Miss T., who wore a green skirt, white chiffon blouse, and a

black hat. Only one of the six described her *skirt* as green. Three said she wore a green *suit*, without mentioning her white blouse. Evidently, green left an impression which later was "remembered" as the only color. One clothed her in a brown skirt. No one noticed her black hat, but four "saw" a red one on her. This was the color of the hat which she had worn in class up to this time.

Miss R. wore a black skirt, white blouse, and a brown hat. She was described by three. All of these said that her hat was black, two of them putting a feather on it, which was true of her brown hat. One saw her in a long grayish coat, and another in a tan coat. As a matter of fact, she wore none.

K., who wore a greenish suit, with coat collar turned up, was described by three. No one noticed that his suit was green. One said that he had on a dark-blue suit, and still another, a dark gray. One said that he had a black eye, which was not true, and no one observed that his coat collar was turned up.

The other attempts at description were either with mistaken recognition or without recognition. That the "descriptions" may be complete I will quote them. "Mr." [identity unknown] "wore a light suit." Another, "the young woman" [this observer saw but one] "had on a large, dark hat, the young man dark clothes." And again, "both of the boys had on dark suits and one of them a green and red striped tie." And finally, "I saw a man all painted, with a red handkerchief around his neck." Neither of the young men was painted, and neither wore any sort of handkerchief on his neck. Recall of the "red and green striped tie" on one of the young men is interesting because, though this observer saw practically nothing but confusion, and though she "recognized" one who had never been in the class and who was not present on this occasion, she, nevertheless, was the only observer who noted the tie of one of the young men minutely enough to recall its red

and green stripes. Evidently, inability to recall and describe certain things is not necessarily proof of the worthlessness of all observations of a witness. An illuminative side-light upon the kind of things observed, even under excitement, is an accurate description, as was afterward learned, of an unplanned, trivial incident. One of the young women in her excitement dropped her purse, and in recovering it she and the young woman sitting next exchanged seats. All this was observed and recalled, and the women identified by a witness who was unable to describe the clothing of any of the participants, and who, in addition, "saw" several things that did not occur.

These descriptions of the participants are all that were given—all that the "witnesses" were able to remember after the excitement through which they had passed, and without suggestions of any sort. Their inadequacy for purposes of identification is apparent. They fit scores of men or women who might have been in the vicinity of the "crime," quite as well as they apply to the actors themselves. Of even greater importance, however, is the fact that the indefiniteness and vagueness of these descriptions indicate a state of mind that makes a fertile soil for suggestions in the form of questions, newspaper reports, and innuendoes in court trials. The descriptions illustrate the rough sketches mentioned above, which can be filled out in a variety of ways to satisfy the bias of the witnesses or the needs of the prosecution. I do not mean that lawyers deliberately set themselves to the task of bringing out false testimony. Examination and cross-examination, however, are in their very nature suggestive, and with soil so admirably prepared for the purpose, an abundant crop of imaginary pictures and scenes will be readily grown. Rough outlines which can be filled in are the structures out of which illusions are made, and the mind's imaginings are the material that gives life and reality to the picture. One who was seen shortly after the events, for example,

is thought of in connection with them, and finally as present at the time.[1]

Several things done plainly in front of the witnesses were either not observed or were wrongly observed. Six saw one of the young women drop something and, of these, four noticed who did it. Only one of them, however, was able to describe the package as a brown-paper parcel. No one saw Miss R. pick it up as she hurried out. Six saw some one pick up the parcel, however, but five of these said it was Miss T., while one thought it was H. This illustrates the tendency to fill in the outline memories. Apparently, all that impressed these six in this connection was that something was picked up. The persons who were not present at the scene were inserted by some of the spectators for one reason or another. Conversation with some one shortly before entering the class, or merely the sight of him, might be sufficient to cause his insertion into the scene as one of the participants.

That sight alone is sufficient incitement to produce "memories" was shown in an exceedingly interesting manner. Two of the witnesses "saw" a dog in the room. Since no dog was present and the word was not used, this interpolation must have had its origin in a stray dog that had been wandering around the quadrangle during the morning and which these two witnesses afterward remembered having seen.

Five heard or saw a pistol-shot. Three of the five saw the flash. "I saw the blaze," wrote one of the young men. "I know some one fired a pistol because I saw the flash," was the statement of a young woman. This, of course, was the result of suggestion. The yellow banana was flourished and then pointed at H. At that moment the toy torpedo was exploded and H. staggered back, crying: "I'm shot." This was all that was said during the

[1] Those interested will find abundant illustrations in *Illusions*, by James Sully.

performance, except as the instructor protested the presence of the "rioters," and ordered them out. Further, the "witnesses" were asked to report what they saw, not what they heard. Hence, the pistol-shot was not suggested by the question. Several other things seen by the spectators but which did not correspond with the facts are also worth recording since, taken in connection with the things mentioned above, they reveal the illusory possibilities of the human mind.

One "noticed Miss T.'s necklace," though she did not wear one and had not been accustomed to do so in the college. As an illustration of the different ways in which the same thing is seen by several witnesses, I will quote the statements of those who described the entrance of H. "Mr. H. was throwing his arms about wildly, and Miss T. was trying to quiet him." "All were beating H." "Mr. U. caught H. as he seemed about to fall." (U. was a member of the class.) "H. came rushing in and fell on his knees." "They seemed to be pursuing H., whom they dragged out of the room." "I recognized only H., and he seemed to be a kind of leader." "They appeared to be trying to subdue H." "H. looked as though he had been seriously injured." This was suggested by the fact that H. entered the room first, and the others seemed to be pursuing him. Besides, when the "pistol" was fired he was the one at whom it was pointed. Finally, one of the young men wrote: "They were attempting to hold back a man with long, black hair." This evidently refers to H., since the other young man had light hair and followed H. into the room. H.'s hair, however, was short. It is another instance of interpolation. The description is that of a young Italian who had been a member of the class earlier in the year, but who withdrew several months before the experiment. Later, this witness in his deposition named the Italian among the participants.

One short report is worth quoting in full because, except

for the recognition of one of the participants, the "witness" unintentionally reconstructed the scene from her imagination. "All I saw," she wrote, "was Miss T. with a tin bucket in her hand. Then I saw a man all painted, with hair standing on end, and with a red handkerchief around his neck. I don't know who he was."

The testimony of the only member of the class who had been forewarned—the young woman who was to have given her report on an investigation—is especially interesting because surprise should have been largely absent in her case and fear must have been wholly eliminated. She had been told that she would be interrupted and that she should not be disturbed but should observe what happened. Her "testimony," therefore, was that of an intelligent young woman who calmly viewed an exciting scene in a more or less impersonal attitude. Yet it contains nothing of evidential value. "I heard screaming," she wrote, "the door was pushed open, a young man rushed in with a young woman hanging on his arm. They were followed by a young man. They went right in front of me; the struggle was followed by a report that I thought was a revolver. I cannot tell who the people were. The young woman had on a large, dark hat and a white shirtwaist. The young men had on dark clothes. They appeared to be below the medium height." The young men were not below the medium height, and, as we have seen, there were two women though she saw but one.

Finally, five of the reports did not contain an item of truth or fiction. These witnesses saw nothing except a mob bursting into the room, and confusion. Six others were unable to testify to anything more than the identity of one of the participants. To these, all else was a blank.

The writer is aware of the difficulty of arranging even a short scene and being sure that it is carried out exactly as planned. In the one of which we have been speaking, however, certain things were definite and these are the ones

upon which we have judged the evidence. The number of persons bursting into the room, their identity, color of clothes, the yellow banana, dropping of the package by one and picking it up by another—these are all matters concerning which there can be no uncertainty. Further, for purposes of control, a departmental instructor, who had followed the rehearsals of the scene, was present to see that nothing was omitted and nothing done that was not provided for in the programme.

Identification is, of course, fundamental in criminal cases, and positive recognition by well-intentioned, uninterested persons is commonly accepted, unless the alibi is convincing. In our drama-experiment the observers were well acquainted with the participants, yet they were surprisingly incompetent as witnesses. Their minds were therefore prepared, had the affair involved a real crime, to recognize one against whom there might appear to be corroborative evidence. The "witnesses" had little definite knowledge of what actually happened. Had a crime been committed their testimony would have had slight value. Yet it would have been accepted because they were eye-witnesses. Only a few identified actors, and in several instances these identifications were so uncertain as to be readily transferred to some one else under the influence of suggestion.

A case[1] in a German police-court illustrates this transfer of identification and also indicates that such mistakes may not be infrequent in actual court cases. A seventeen-year-old boy, named Zinny, was accused of having stolen certain articles from a house. The evidence showed that the thief, in the attempted flight and pursuit, threw the things away, and that Zinny, when caught and brought back was at once recognized as the robber by the wife of the janitor of the apartment. She also identified the defendant as Zinny, the thief. Further, two men swore that the defendant was the man whom they had seen carrying the

[1] *Archiv. f. d. gesamte Psychologie*, vol. 9, p. 71.

things out of the gate, and who was pursued and caught. The identification seemed perfect and no witnesses were called for the defense. Before passing sentence the judges asked the defendant whether he had anything to say for himself. To the amazement of the court he replied that the verdict did not interest him in the least because he was not Zinny, but Nowakowski. The explanation of this farcical ending to a serious trial was that some days before Nowakowski had been convicted by testimony which he knew to be false, though perhaps not intentionally untruthful. He had, therefore, arranged with Zinny to exchange rôles in the court proceedings. He took Zinny's place to show the judges how little reliance can be placed upon testimony regarding identity. The court felt that its dignity had been trifled with and its feelings cruelly wounded, and the judges could be convinced that the testimony of so many honest folk was erroneous only after the real Zinny and the jailer were brought before them and had verified Nowakowski's identification of himself. It was then learned, to the further discomfort of the judges, that one of the prosecuting attorneys in the trial of "Zinny," one of the presiding judges, and a subordinate court official, had participated in the original case against Nowakowski, and yet did not recognize him when he appeared before them as defendant in the assumed rôle of Zinny.

Returning now to the general question of observation and its evidential value, several drama-experiments similar to the one described from the classroom of Washington University have been enacted by others for the same purpose. Some of these scenes, in the opinion of the writer, are too complex—they test observation of details that could hardly be expected under excitement; yet all conform reasonably well to the conditions of an actual crime thrust unexpectedly upon the attention of witnesses who later are called into court to testify to what happened.

Von Liszt, professor of criminal law in the University

of Berlin, staged the following scene[1] in his seminar. The members of the seminar were discussing Tarde's investigations. Professor von Liszt asked: "Has any one something more to say before I give the floor to the first speaker to sum up the results?" One of the students arose and was given the floor. "I wish to discuss Tarde's doctrine from the standpoint of Christian ethics."

"That's all nonsense," exclaimed another student, rising excitedly.

"Keep still until you're spoken to," shouted the first.

"That's an insult," cried the second, jumping up.

"If you say another word—" exclaimed the first, advancing with clinched fist.

"Drop your hands," shouted the second, drawing a revolver and thrusting it into his face.

Professor von Liszt seized the man's arm, the revolver dropped to the level of the breast of his adversary and was fired. The members of the seminar, who still believed that they had witnessed a real quarrel which just missed being a tragedy, were then told that, since the affair would doubtless be investigated in the courts, they had better write down what had occurred. Some of them did so at once, and others at varying intervals of time. As was to be expected, no one saw and heard what had happened. Those who took no part were made participants by word or deed, and the real actors were made to do things that had not occurred.

Drama-experiments, such as have been outlined, were first tried because of rather startling attacks upon the value of testimony. Binet had previously published[2] a mass of convincing evidence of the subtle influence of suggestion. He insisted that all questions, even the most innocent, suggest details to the witness which he then honestly be-

[1] L. W. Stern, *Zur Psychologie d. Aussage.* Reviewed in *L'Année psychologique*, vol. 12, p. 182.

[2] *La Suggestibilité.*

lieves he observed. Even if they do nothing worse, in Binet's opinion, they force the memory to be exact in matters that are vague and uncertain. Forced memory, Binet found, gives 26 per cent of errors. When a moderate suggestion is combined with the forcing process the errors rise to 38 per cent. After the witness has committed himself there is a tendency to adhere to the statement and finally to believe it.

The growth and spread of suggestion is, of course, well known, but Defoe gives such a good illustration from the Plague of London that it is worth quoting.[1] "Another encounter I had in the open day also," he says; "and this was in going through a narrow passage from Petty France into Bishopsgate Churchyard, by a row of alms-houses. . . . In this narrow passage stands a man looking through between the palisades into the burying-place, and as many people as the narrowness of the passage would admit to stop without hindering the passage of others, and he was talking mighty eagerly to them, and pointing now to one place, then to another, and affirming that he saw a ghost walking upon such a gravestone there. He described the shape, the posture, and the movement of it so exactly that it was the greatest matter of amazement to him in the world that everybody did not see it as well as he. On a sudden he would cry: 'There it is; now it comes this way.' Then, ''Tis turned back'; till at length he persuaded the people into so firm a belief of it, that one fancied he saw it, and another fancied he saw it; and thus he came every day making a strange hubbub, considering it was in so narrow a passage, till Bishopsgate clock struck eleven, and then the ghost would seem to start, and, as if he were called away, disappeared on a sudden." Again, to cite a more recent instance, every one remembers the Cossacks tiptoeing through London at the beginning of the present war. They were "seen" by many, and, though they vanished like

[1] *Journal of the Plague Year*, London, 1900, p. 27.

ghosts, their number was variously estimated from 35,000 to 1,000,000. It was, then, facts similar to these that led Binet and Stern[1] to doubt the accuracy of much of the testimony that is given, and to undertake the experimental examination of evidence.

Some of the experimental results were obtained by the so-called picture-method. The "witnesses" examined a picture for a minute, more or less, and then wrote a description of it from memory. Sometimes they were questioned about the things they omitted or upon which they only touched. The conclusions from these experiments were sufficiently impressive to attract the attention of jurists, but it was maintained that the picture-test is a long way removed from the conditions of every-day life with which courts have to deal. They are concerned, it was said, with events and "adventures" in which emotions play a leading part. So von Liszt, at Stern's request, prepared and staged the drama-experiment to which reference has been made.

As a matter of fact, however, picture-tests have demonstrated a number of things in the psychology of testimony that probably could not have been singled out and discovered in drama-experiments. Picture-tests easily lend themselves to scientific accuracy. Scenes, even short ones, are difficult to stage exactly as prepared. Something may be inadvertently introduced or omitted, and the change escape the observation of the participants. To be sure, these errors in the production may be to a great extent eliminated by having some one present who knows what should be done, as was the case in the writer's drama-experiment. But even then something regarded as important may be slurred and the defect in the performance escape the attention of the control-witness. Besides, this control-witness is subject, if in a less degree, to the psychology of other observers. He is not altogether immune

[1] L. W. Stern, *Beiträge zur Psychologie d. Aussage.*

to the contagious emotions of the moment. So the conclusions from picture-tests must supplement those gained from scenes more comparable with the events of life.

Let us then briefly consider a few of the results of the picture-tests. All investigators agree that accurate testimony is the exception and not the rule. The imagination helps out the memory. Stern[1] tested a number of university students and professors, allowing them to examine a picture for forty-five seconds. They were then requested to write immediately a description of the picture. These descriptions were repeated at the end of five, fourteen, and thirty-one days. Since the observers were forewarned that it was a test of observation, and that they would be asked to write what they remembered, they naturally examined the picture in detail and with great care. There was the maximum of attention. Moreover, the test was devoid of excitement and of personal prejudices; and there were no suggestions either by questions or by conversation among the participants. Further, the observers were intelligent persons in the best years of their mental vigor, from seventeen to forty-six years of age. For these reasons the results may be regarded as revealing the least average errors for observation in daily life. Yet, even under these exceptionally favorable conditions, the errors were nearly 6 per cent in the reports written immediately after the observation, and averaged 10 per cent in the subsequent descriptions. Out of two hundred and eighty-two reports only seventeen were correct, and fifteen of these were among those written immediately after examination of the pictures.

It is generally agreed that questions increase the range of testimony regarding what has been observed, but there is less accuracy than in free narration. Mlle. Borst[2] found

[1] *Op. cit.*

[2] *Archives de Psychologie*, vol. 3, p. 298. See also Arthur Wreschner, *Archiv. f. d. gesamte Psychologie*, vol. 1, p. 148.

a few more correct statements when the witnesses were questioned, but the number of replies in which errors were mingled increased in a greater proportion. The net result, therefore, was less reliable than in free narration. One is always prone to tell more than one knows, and every question is another temptation. Narration, on the other hand, is thought by some to give too loose a rein to fancy. It should not be forgotten, however, that the credibility of a witness is one of the things to be settled before accepting his testimony, and unlimited freedom to talk himself out gives valuable evidence regarding his accuracy. Indeed, quantity and quality of testimony are frequently in inverse ratio; and in this connection Mlle. Borst, with keen psychological insight, observes that forgetfulness is one condition of reliable testimony, *provided the witness is aware of his tendency to forget.*[1] Attention is rigorously selective, and this selection is based on the relative importance of the details; but it should be remembered that the choice of what is important is a personal matter. A thing has only the importance that one gives to it. Its significance as evidence may be quite different. Colors, size, and duration of time, for example, are often fundamental in court cases, yet evidence regarding these matters is commonly unreliable.

As to the effect of lapse of time between observation of an object or event and testimony regarding it, there is not complete agreement. As personal or public interest in a matter increases, however, accuracy seems to decrease at a rate which may seriously discredit honest testimony, especially when the case is one that causes much talk and gossip during the interval. The experimental investigations of this question are probably too favorable to delayed evidence because the "witnesses" were usually asked not to discuss the matter with one another, and there were no personal or emotional factors involved.

[1] *Op. cit.*, p. 301.

Another approach to this subject of testimony is the influence of the oath. The manner of administering the oath in these investigations is to ask the "witnesses" to underline the statements to the accuracy of which they would be willing to swear. Mlle. Borst concludes[1] from her investigations that about a twelfth part of sworn testimony is false. Stern puts a lower value upon it, and Larguier des Bancels,[2] after reviewing various investigations, is of the opinion that, in general, a tenth of the honest evidence given under oath is untrue. One of the "sworn statements" obtained by Stern is worth quoting. This witness, a young man, occupied the eighteenth place in the list based on the percentage of errors. The statement, written three weeks after the observation of the picture, runs as follows: "The picture shows an old man seated on a wooden bench. A small boy stands at his left. He is watching the old man feed a pigeon. Another pigeon is perched on the roof ready to fly down to be fed." As a matter of fact there was no pigeon in the picture. The boy himself was being fed with a spoon by the old man from a dish held in the man's lap.[3]

Testimony is a solemn affirmation, usually given under oath in courts of justice. Its social counterparts are repetition of conversations, spreading of rumors, and reports of scenes which have been heard or read. These latter differ from testimony chiefly in the occasion that prompts them; and their social function gives them a peculiar in-

[1] *Op. cit.*, p. 313.

[2] *L'Année psychologique*, vol. 12, p. 214.

[3] No attempt has been made to cover the literature of this subject. It is already too extensive to treat in a single chapter. Those who are interested will find 127 titles at the end of John H. Wigmore's popular article in the *Illinois Law Review*, vol. 3, p. 399. Professor Wigmore, unrestrained by a judge, has followed the lawyer's method of confusing the issue with much irrelevant matter. In this way his article is made more interesting but less valuable. Subsequent investigations are listed in various numbers of the *Zeitschrift f. angewandte Psychologie*, the successor of the *Beiträge zur Psychologie d. Aussage.*

terest. Let us therefore see how accurately such reports are reproduced.

In order to test memory of a short narrative the following newspaper item was slowly read to six college students, members of the beginning class in psychology in Washington University—to which freshmen are not admitted—and each of these six immediately repeated it from memory to a group of five. All, both the leaders and members of the several groups, then wrote it down:

"A Greek naval officer who was on board the cross-Channel steamship *Sussex* when she was damaged by an explosion made a report of the occurrence in which several Greeks lost their lives.

"The officer asserts there is no reason to believe that the *Sussex* was torpedoed, and declares that the vessel must have struck a mine, possibly one of British make. According to this report, the *Sussex* carried only four lifeboats, which were not sufficient to accommodate the passengers and crew.

"The captain of the *Sussex* was killed when the explosion occurred, and the first officer, on sending out a wireless call for help, gave the wrong position of the ship. As a result of this error the arrival of aid was delayed and the number of victims was increased."

In estimating the accuracy of memory, this selection was divided into six statements. The first corresponds to the first paragraph, the second to the first sentence of the second paragraph, and the third to the second sentence. The last paragraph was divided into three statements, that the captain was killed by the explosion, that the first officer gave the wrong position by wireless, and that as a result of the delay caused by this error the number of victims was increased. It would have been easy, of course, to further subdivide the "story," but it seemed best to take the large conspicuous features. This, of course, gave the story-teller the advantage in estimating the accuracy

of the reports. In computing the results, omissions were counted as errors, but a statement was regarded as correct if the central thought was given. It was not expected that the hearers would remember the wording. Since only the substance of the statements was required the results are rather startling. Of the leaders of the groups, to whom the news item was slowly read by the instructor, and who wrote it down as soon as they had repeated it to their several groups, three made a record of sixty-six and two-thirds per cent of correct reproduction, one of fifty per cent, and two of thirty-three and one-third per cent. Among the members of the groups to whom the leaders repeated the news story immediately after it was read to them, four made sixty-six and two-thirds per cent, one fifty per cent, four thirty-three and one-third, twelve sixteen and two-thirds, and two failed to remember any of the story. They were, therefore, marked zero. A number added incidents not contained in the selection. This was especially noticeable with those who remembered little or nothing of what they heard. The writer is aware that mathematical accuracy cannot be ascribed to these figures. Recollection, at times, was neither wholly right nor wholly wrong. In such cases the percentage of correctness had to be, in part, estimated. In the writer's opinion, however, the figures are essentially correct; and he believes that they are fairly representative of the accuracy of stories in the second and third repetition by different persons. It should be emphasized that these students knew that their memory of the story was to be tested. This increased their attention. Yet, even with this added incentive, their reproductions were not remarkable for accuracy. Evidently, memory of what one has been told should always be regarded with suspicion.

There is, however, another interesting question connected with this matter of reports and rumors. Through how many mouths must a story pass before it loses its identity?

To test this the following newspaper clipping was read to one member of the class who, in turn, repeated it at once to the next, and so on to the end. As soon as a student had heard and repeated it, he (or she) immediately wrote it down. It will be observed that the story is shorter than the preceding:

"Thomas McCarthy, who has also used the names Burns and Hopkins, was arraigned yesterday on the charge of having conspired to forge and pass stolen money orders. His case was adjourned for a week. He was arrested on Monday night in a saloon. The Assistant District Attorney said yesterday that the score of money orders, which the man was accused of passing at department stores, were some of those stolen by yeggmen a month ago from a Post Office in St. Louis. The orders had been filled in for varying amounts, none of which were more than $100. McCarthy was held in $10,000 bail."

The first paper, perhaps, had better be quoted that the readers may see how it started down the line. "Thomas McCarthy, who formerly gave the name of Burr and Buss, was arrested for forgery. The trial will come in a week. He was arrested last Monday night in a corner saloon. He tried to pass checks formerly used by Leighton in the department stores. Since none of the amounts were over $100 he was let out on $1000 bail before the district attorney."

Beginning with the second attempt at reproduction of the story there were continuous and increasing omissions and additions, with frequent changes in the aliases. The seventh report was so far reduced as to be worth quoting. It is as follows: "There was a man named McCarthy who went by the name of Burney. He forged a check for $100 and was arrested." Number eleven lost the surname and changed the alias to "Sussex," evidently because of the story heard two days before. The story now becomes: "There was a man named Thomas. He went by the name

of Sussex. He forged a check for $100 and escaped." Here the story may be said to have lost all resemblance to that with which number one began. This test, like the preceding one, gave memory an advantage that it does not have in matters of every-day life. We do not usually expect to be called to account for our information. Hence we are less attentive. These students were interested in the experiment. There was rivalry to see who could remember most accurately. They concentrated their attention to the limit of their ability. Yet the results were chiefly remarkable for their omissions and additions. Second-hand reports are undependable, and after they have passed through three or four mouths, in intervals of several days, they are quite certain to have little or no resemblance to the original story.

In conclusion, let us refer again to the questions asked at the beginning of this chapter. First, what are the chances for a truthful narration of that which has been seen or heard? Clearly, the chances of even a reasonably accurate narration are small. We have found observation itself exceedingly defective and unreliable; and when to the inaccuracy of observation there is added the disturbing effect of intervening time, with the deflecting influence of conversation about the events and the excitement of the imagination, the testimony of witnesses becomes extremely undependable. Imagination reconstructs events with many omissions and substitutions, and the final outcome is likely to be so different from the original as to be almost unrecognizable. Expectation of an act may cause it to be seen, and intention to do something translates the thought into deed. Suggestion is always operative—suggestion of actions when one is an observer, and suggestion from questions, even of fact, in conversation or when on the witness-stand.

The second question was, Does the feeling of accuracy guarantee substantially correct statements in testi-

mony or conversation? The evidence and experiments again enter a denial. Confidence and assurance signify little. A man may think an occurrence so intensely in connection with other events that it assumes a place among them. He then "remembers" that it happened. Bias, of course, is operative both in observation and in memory, and at the end it exerts a powerful influence upon the feeling of accuracy.

Finally, knowledge of the inadequacy of observation and memory, and conviction of the possibility of error by oneself are the best guarantees of truthful reports. The most positive witnesses and narrators of conversation are to be regarded with suspicion because of their very assurance of accuracy.

CHAPTER IX

OUR VARYING SELVES

It could hardly have been Stevenson the romancer who made Doctor Jekyll say: "It was on the moral side, and in my own person, that I learned to recognize the thorough and primitive duality of man; I saw that of the two natures that contended in the field of my consciousness, even if I could rightly be said to be either, it was only because I was radically both." Rather, this was Stevenson the observer of human nature, who in common with all great novelists, possessed much of psychology and a bit of philosophy for the reflective moments of his characters.

Howells has graphically described these varying selves in the same person through the observation of one of his characters in *April Hopes*. Mrs. Brinkley was speaking of the Pasmer family but with special reference to Alice Pasmer.

"'The Pasmers are the dullest and most selfish people in the world,' she exclaimed.

"'Oh, I don't think that's her character,' said Miss Cotton, ruffling her feathers defensively.

"'Neither do I. She has no fixed character. No girl has. *Nobody* has. We all have twenty different characters—more characters than gowns—and put them on and take them off just as often for different occasions. I know *you* think each person is permanently this or that; but my experience is that half the time they're the other thing.'"

We all of us think that we know what the "self" is but the moment we try to describe it, difficulties arise and its various, contradictory characteristics become apparent. We readily distinguish between ourselves and other individuals. Our feelings, thoughts, interests, and emotions, generally, are also distinctive. They may be shared, to a

certain extent, by others, but our own radiate a warmth that makes them personal. Here, too, diversity within the "self" becomes evident. Self-appreciation and ambition conflict with humility; material prosperity with social and ethical ideals; self-preservation, or its more modern counterpart, self-advancement, with the rights of others. Perhaps, though, it is in action, the outward expression of our varying and conflicting emotions, that the contradictory character of the "self" is most noticeable. "I was not myself when I did that," is a frequent excuse; and this defense has passed over into law in the distinction between premeditated and unpremeditated homicide. At times the variations pass beyond the normal and an individual exhibits peculiarities so diverse that they have no common bond, not even that of memory connecting the varying selves. It is the intention of the writer to consider only normal variations, except for one case of peculiar interest because it approaches the parting of the ways.

Just because people are prone to think themselves more consistent than they are and because the opinion is rather prevalent that only under pathological conditions do varying personalities dwell side by side in the same individual and reveal themselves successively, just for that reason a survey of alternating selves in the same person seems profitable. All is grist that comes to your mill if you once begin to consider this question—all literature, history, biography, your friends, neighbors, and family. Even the crowned heads of Europe offer a crop for the garnering. Some recompense for the effort may be a quickened understanding of human nature and a keener appreciation of its incongruities and consequent frailties.

A bit of reflection will soon convince us that we are a strange composite of selves. No one can be labelled and tagged for any length of time. No one completely reveals himself at any moment. Proverbs such as "You must eat a peck of salt with a man before you know him" in-

dicate that the experience of the race confirms this human characteristic. Sometimes we reveal alternately different or conflicting selves. Again, we possess two selves struggling for the mastery, either consciously or unconsciously. The self may change with physical conditions, fatigue, age, environment, companions, ambition, and mood.

We may dismiss briefly the influence of physical well-being and fatigue. The familiar amiability after a good dinner and the distorted mental vision due to fatigue or pain are generally recognized, and the necessity of reckoning with these factors has become axiomatic. Just how far the control of the self is possible and what its relation to conduct is will be touched upon later. But first let us turn to some of the many types of personalities that refuse to fit into an orderly scheme and yet are not unusual.

General George B. McClellan's *Own Story*[1] contains excellent illustrations of two or three of the twenty characters that Mrs. Brinkley thinks every one has. "I pray every night and every morning that I may become neither depressed by disaster nor elated by success, and that I may keep one single object in view—the good of my country." Compare this humility with the attitude expressed in the following passages in which modesty has entirely vanished and his view of himself is immensely enlarged. "Had the measures recommended" [by himself] "been carried into effect the war would have been closed in less than one-half the time and with infinite saving of blood and treasure."[2] And, besides, he tells us of the acknowledgment of generous enemies "that they feared me more than any of the northern generals, and that I had struck them harder blows when in the full prime of their strength."[3] There is even evidence that he so far forgot "the good of my country" as to permit thoughts of a dictatorship to flash through his mind; but perhaps this was another way of saving the country from the inefficiency of the other generals. "How

[1] P. 173. [2] P. 105. [3] P. 35.

these brave fellows love me," he is reported [1] to have said to one very near to him, "and what a power their love places in my hands! What is there to prevent my taking the government into my hands?" Could one ask for two more widely varying selves? Yet each was apparently unaware of the existence of the other. A study of McClellan's life has convinced the writer that he was earnestly desirous of serving his country at the cost of any personal sacrifice and that the other self—the self-aggrandizement—came into no noticeable conflict with his self-sacrificing loyalty.

Sometimes the two sets of ideas or beliefs are more clearly contradictory. People with such conflicts, like those of the McClellan type, are not aware of the contradiction because the two systems of thought flow along in parallel streams without overflowing their banks and mingling with one another. Stanton seems at times to have exhibited even more striking contradictions. In a letter to Dana, written in February, 1862, he exclaimed: "Much has been said of military combinations and of organizing victory. I hear such phrases with apprehension. They commenced in infidel France with the Italian campaigns and resulted in Waterloo. Who can organize victory? Who can combine the elements of success on the battlefield? We owe our recent victories to the Spirit of the Lord that moved our soldiers to rush into battle and filled the hearts of our enemies with dismay." [2] This is interesting from one who devoted tireless energy to organizing victory. "From the moment he took hold of the war machine, he saw that every part was in order, so that his own work and others' work would not be thrown away. And back of the labor, the system, the insight, was the animating soul, an enormous, driving energy, which thrust

[1] *Union Portraits*, by Gamaliel Bradford, p. 15. Quoted by Bradford from Piatt's *Memories of the Men Who Saved the Union*, p. 294.

[2] *Recollections of the Civil War*, by Charles A. Dana, p. 7.

right on through obstacles and difficulties, would not yield, would not falter, would not turn back. . . . The very life and heart of the war depends on railroads. Stanton sees it and gets men like Haupt and McCallum out of civil life to do feats of engineering which command the admiration not of America only, but of the world." [1] This does not look like trusting to the "Spirit of the Lord that moved our soldiers to rush into battle and filled the hearts of our enemies with dismay."

Sir John Hawkins offers another illustration of this contradiction of ideas and beliefs. His love for his fellow sailors led him to devote his fortune to founding a hospital for indigent sailors. Yet this fortune was made in the slave traffic in which on his own boats and with his knowledge the most atrocious cruelties were practised, the slaves being treated far worse than cattle. Again as we have found, people of some scientific knowledge, who surely realize the supreme importance of human life, are misled by an orgy of sentimental sympathy through the phrase "cruelty to animals," to oppose animal experimentation for the relief of human suffering. As an instance of the curious separation of personalities in some of these people, Havelock Ellis remarks: "I have often noted with interest that a passionate hatred of pain inflicted on animals is apt to be accompanied by a comparative indifference to pain inflicted upon human beings, and sometimes a certain complaisance, even pleasure, in such pain." [2] The truth of this observation is supported by a news item in the daily press [3] immediately after the

[1] *Union Portraits*, by Gamaliel Bradford, pp. 188 *ff.*

[2] *Impressions and Comments*, p. 154.

[3] December 15, 1917. Verified in all essentials by letters from Mr. Murray and from the Massachusetts Society for the Prevention of Cruelty to Animals. The money—over $1,400, as it turned out—was raised by popular subscription. Consequently, the charter of the Society would not have forbidden the collection and use of the money for relief of the sufferings of human beings, had the Society so desired.

Halifax explosion. "R. H. Murray, Chairman of the Animal Relief Committee," the communication says, "announced to-day the receipt of a telegraphic contribution of $1,000 from the Massachusetts Society for the Prevention of Cruelty to Animals. The gift, which is to be used in caring for animals injured or made homeless by the disaster, came as a great surprise to Mr. Murray and was deeply appreciated. The Massachusetts Society has also sent two of its trained agents to assist in the animal relief work." And this money was sent for the relief of homeless animals when men, women, children, and babies were dying of cold and hunger, when human beings were suffering indescribable agony from their injuries, and sufficient money could not be obtained to relieve the anguish. Yet these good people are not by nature brutal. It is just an amazing exhibition of two selves which are not allowed to intermingle so as to make one consistent self.

Turning to a different type of varying selves, there are people who, though well aware of the bacterial origin of certain diseases, believe that bacteria can be thought out of the body. And they would also treat the wounded bodies of soldiers by the action of the mind. As though bullet-holes in heart and lungs could be closed by thoughts! Yet these persons accept scientific values in other matters than bodily injuries. They recognize cause and effect in the external world. And their manner of reasoning, when out of hearing of their enticing siren, is quite up to the average.

The same irreconcilable conflict not infrequently exists between altruistic and business ideas. A man may be hard and even cruel in his business dealings yet give generously to philanthropic organizations and to his church. The recent investigation of vice in Baltimore is an extreme illustration. The report of the commission has not been published. It is doubtful if it ever will be, be-

cause it would expose the double personality of too many men high in business, social, and religious life.

Not long ago a $6,000-a-year manager of a large company, who was accused of being the leader of a gang of highway robbers, suddenly rose in court at his trial in Brooklyn and cried: "I am guilty. I have lived two lives, a respectable one and that of a highwayman." When he sat down the other defendant, an auditor of another large corporation, arose and said that he also wished to plead guilty.

An exceptionally convincing illustration of the business self, as distinct from the social and religious selves, is given by Al Jennings as a part of his experience as a convict in the Ohio penitentiary.

"One day as I was driving my machine a well-dressed man stepped up beside me and watched the nuts hammering out into the box. I recognized him; he had an interest in the contract.

"'What is the capacity of this machine?' he asked.

"'Fourteen pounds an hour, sir,' I replied. I quote this and the following figures from memory, I may have them wrong.

"'How many pounds do you turn out?' he proceeded.

"'Sometimes only eleven, sometimes as much as thirteen,' I replied.

"'If you'll speed this machine up without breaking it I'll give you a quarter of a cent a pound for every pound you make over ten,' he said. That meant perhaps ten cents a day—only a little, but it gave me an object in life. No free man understands what that means to a fourth-class convict.

"The nut-machine was a delicate thing, and must be sped up cautiously. Twisting a screw a sixtieth part of an inch too far might smash all the tools on the head-block. I nursed it like a baby, and ran it almost to capacity. By the end of the month I had earned—if I remember right—

something more than two dollars. On pay-day I presented myself in line for the money. The clerk stared at me—he couldn't find my name on the list.

"I complained to the general manager of our shop. He looked sorry for me as he said:

"'I don't want to hear any more about that. He did it to prove that you could speed up the machine. It's an old trick.'" [1]

It may be said that this contractor could not have been a respected member of good society but, unfortunately, the facts of this and other similar cases do not justify this view. Such men often have good intentions but they do not allow their moral ideas to overlap and disturb their business methods. They would be uncomfortable if they did. Consequently, ideas arrange themselves so as to cause the least possible discomfort. This is a phase of man's unconscious adaptation to his environment. It is the mental side of the adaptation. Like the lower animals, man recoils from the unpleasant and seeks that which produces an agreeable feeling. So far as his thoughts are concerned this is accomplished by allowing them to arrange themselves in more or less isolated systems of ideas which, as it were, constitute separate personalities—different selves.

An instance of isolated systems of thought is reported of Charles Sumner. A poor woman whose claim had been rejected by the Senate was asked why she did not take it to Sumner, the senator from her State. "Oh, sir," she replied, "I did, but really, sir, Mr. Sumner takes no interest in claims unless they be from black people." [2] Gideon Wells, speaking in a similar vein, once said: "Sumner would not only free the slaves, but elevate them above their former masters, yet, with all his studied philanthropy and love

[1] *Beating Back*, pp. 204 *f.*

[2] *History of the United States from the Compromise of 1850*, by James F. Rhodes, vol. VI, p. 24.

for the negroes in the abstract" [he] "is unwilling to fellowship with them, *though he thinks he is.*" [1]

In the instances given above it would seem as if the contradictory natures existed without even a struggle in the consciousness of the person. There is, however, another group in which two selves fight for supremacy. Now one gains the upper hand, and now the other. He in whom the contest is waging may not even know that anything is happening. His ability to know himself depends largely upon his sense of humor, or, which comes to the same thing in the present instance, upon his capacity to take as impersonal and objective a view of his own actions as he gets of those of others. If he can stand off and look at himself he may see the joke—or the tragedy.

H. G. Wells, in his picturesque way, describes two of these opposing selves as they manifested themselves in Mr. Britling. "This double refraction of his mind," he says, "by which a concentrated and individualized Britling did but present a larger impersonal Britling beneath, carried with it a duplication of his conscience and sense of responsibility. To his personal conscience he was answerable for his private honor and his debts, and the Dower House he had made, and so on, but to his impersonal conscience he was answerable for the whole world. The world from the latter point of view was his egg. He had a subconscious delusion that he had laid it. He had a subconscious suspicion that he had let it cool and that it had addled. He had an urgency to incubate it. The variety and interest of his talk was largely due to that persuasion; it was a perpetual attempt to spread his mental feathers over the whole task before him." [2] After Mr. Britling had lain awake for a long time one night, worried almost to distraction about the troubles of England and his own affairs, including his pleasant though naughty little love

[1] *Diary*, vol. 1, p. 502. (The italics are the present writer's.)
[2] *Mr. Britling Sees It Through*, p. 102.

intrigues, he suddenly threw back the bedclothes, felt for the matches on his bedside table, "lit the stove and then strolled to his desk. He was going to write certain 'Plain words about Ireland.' He lit his study lamp and meditated about it until a sound of water boiling called him to his tea-making.

"He returned to his desk stirring the lemon in his glass of tea. He would write the plain common sense of this Irish situation. He would put things so plainly that this squabbling folly would have to cease. It should be done austerely, with a sort of ironical directness. There should be no abuse, no bitterness, only a deep passion of sanity.

"What is the good of grieving over a smashed automobile?

. . . . . .

"The next morning Mr. Britling came into Mr. Direck's room. He was pink from his morning's bath. . . . In the bath room he had whistled like a bird. 'Had a good night?' he said. 'That's famous. So did I.'"

Victor Hugo once said that at times he felt two natures struggling within him, and Al Jennings, the reformed train-robber, in commenting upon this, says: "I worked that out for myself before I ever heard of Hugo. Only I believe that in me those two natures are more widely separated than in most men. I kept the better nature dominant until the killing of my brother Ed. From then on the worst nature ruled my actions. Now, with my new hope, I found the worst nature going down and the better coming up. It didn't happen all at once. I had my bad days, when I felt the yearnings to break loose and run amuck. But I managed to control these impulses, and, as time went on, they became weaker and less frequent." [1]

Apropos of our struggling natures, reference may be

[1] *Beating Back*, pp. 242 *f.*

made to Elbert Hubbard, who represents a phase of human psychology by no means rare. His early literary experience was the agony of failure. He besieged the leading magazines but his manuscripts were always rejected. "Strange," says one of his reviewers, "that no editor had the intelligence to appreciate Hubbard," with his wit and dash and originality. "Then there would have been no 'Philistine' and no 'gospel of protest,' and none of those very Roycrofty jokes." His better self, perhaps his real self, would have persisted. But in his bitter disappointment the other self appeared.

After a man is dead it is comparatively easy to estimate him with calmness and justice. The fact that he cannot talk back and defend himself urges even his bitterest enemies to fairness. During the life of Fra Elbertus the best that one commonly heard said of him was that he was original, witty, and a great advertising success. Of the unbeautiful things said, there were many. According to one writer,[1] Mr. Harry Taber was the author of "A Message to Garcia." The sage of Aurora, as Mr. Hartt tells the story, received the manuscript for publication, "wrote an introductory paragraph, a conclusion, and an occasional interpolation, and published the essay over his own signature." A fair-sized volume could be filled with other unlovely acts reputed to this exponent of beauty.

"On the other hand," continues Mr. Hartt, "I have listened as cordially to accounts of the man's nobler side. From a lady formerly employed at the Roycroft Shop I learned that he had times of bitter repentance and would go and hide in a hut where no one was allowed to come near him. She believed, just as I do now, that there were two Elbert Hubbards, both real, with a frightful warfare between them. It was a real Elbert who took the threadbare clergyman to Chicago, and befriended the ex-convict, and preached a glowing idealism even after the highly

[1] Rollin Lynde Hartt, *Boston Evening Transcript*, May 5, 1915.

peculiar circumstances attending his divorce and remarriage. It was a real Elbert who announced himself as the 'American successor of William Morris,' while exploiting the sort of woman who would 'pay twenty dollars a volume for a book like that.' It was a real Elbert who won the undying loyalty of his admirers. I recall a letter that said hotly: 'How can you traduce that good and great man?'

"Good? Yes, doubtless—better than most of us; capable of generous purposes and fine deeds; tearing his hair over his weaknesses; wishing to God he were rid of them; and yet lacking the moral vigor that would have destroyed them root and branch.

"At the same time give him credit for a courage, rare in our day, to stand up for his ideals in the very face of his known failures. Most men, exposed as he was exposed, and he continued diligently to expose himself, would have shut up about sweetness and light and the life beautiful. Hubbard refused to. If he could not be what his best self earnestly wanted to be he could fight in behalf of his best self's aspirations, nevertheless, and it was not hypocrisy." But his pretensions made him very vulnerable.

The struggle of a suppressed self for expression takes various forms in different persons. In Hubbard, if Mr. Hartt has rightly interpreted him, it was a moral revolt. After his failure to get a hearing in the leading magazines, the business self, with which he was richly endowed, emerged with all its unloveliness. Hubbard understood human nature well enough to know that people enjoy a fight so long as they are safe within the side-lines. So he conceived the idea of a magazine of protest, striking at whatever the multitude would enjoy seeing hit. And there are many such things especially if one uses vague phrases which arouse emotional effervescence instead of thought.

Turning aside from varying types of personality, let us

consider briefly some of the explanatory influences. Growth, of course, always brings the changes of development and advancing years; but these alterations do not exhibit contradictions. The differing selves of maturity, however, which alternate with more or less regularity are a composite product of the natural endowment of the individual and the social or commercial environment, the surrounding opinions, and the apparent demand for certain views or actions. The result is a consciously or unconsciously simulated attitude which finally becomes so fixed that the original personality reveals itself only when the man is taken off his guard, as in the case of one who tries to act a part, or, when the better impulses of a weak man with high ideals occasionally assert themselves in opposition to the pressure of environmental influence.

Environing conditions are probably quite as responsible for the behavior of other men as they seem to have been in the case of Jennings. It is not correct to say that "every man has his price," but psychology forces us to admit the all but resistless power and final triumph of the summation of stimuli, or, which comes to the same thing in the present instance, of impressions from the outside world. Constant dropping finally wears away the stone, and the nervous system is not less easily affected. It is, of course, an intricately complex process, and the influence of the forces that contribute to the final response of a human being cannot even be estimated, much less measured. Racial factors are continually in evidence. They constitute the undercurrent that always influences the flow of thought, and hence play a hidden rôle in action. In emotional vortices, when thoughts run madly round and round, these racial tendencies rise to the surface and sweep ideals aside. In calmer moments the individual's past life, his convictions and aspirations assert themselves, but in stress and strain it is a contest between the forces of the racial self and the teachings and habits of the individual.

In moral actions a man's better self, his family heredity and early education, at first assert themselves, but, after a long period of continuous battering, the stimuli from lower ideals are usually victorious. Defaulting bank cashiers rarely, if ever, take large sums of money at the outset. They begin with small amounts which they confidently expect to return. Soon, however, the resistance lessens, and then the final defalcation, with its accompanying publicity and ruin, follows. Only the strongest characters can withstand the effect of summation of stimuli. It is probably this fact in human psychology which Stevenson had observed that led him to make Doctor Jekyll say: "All things therefore seemed to point to this: that I was slowly losing hold of my original and better self, and becoming slowly incorporated with my second and worse."

One cannot help wondering whether this continuous battering of the stimuli of political life is the explanation of the two selves manifested by Seward, if Frederic Bancroft's estimate[1] of him is correct. Speaking of the two "voices" to which Seward was always listening—radicalism and conservatism, aggression and caution, thoughtful disinterested statesmanship and opportunism, lofty patriotism and self-advancement, his biographer says: "Seward continued to hear the two voices—in fact, he continued to act two distinct rôles. It was John Quincy Adams Seward who uttered the telling phrases and made the severe arraignments and was the hope of the radicals like Gerrit Smith, Theodore Parker, and, at times, of the Garrisonians. . . . On the other hand, Thurlow Weed Seward kept in close relations with the party organization; he watched the plans of the politicians, changed the program to suit conditions, and tried to win all classes of men. Adams Seward was ardently antislavery and expected to live in history as a great philanthropist. Weed

[1] *Life of William H. Seward*, vol. II, pp. 86 *ff.*

Seward was determined to control the patronage and to live in the White House. . . . A statesman in character and purpose, he was yet a consummate opportunist. . . . However, nothing of which absolute knowledge is impossible is more certain than that he was never consciously inconsistent."

As we have already shown, no one is composed of just one set of ideals converging toward a definite, conscious end. A man wishes to be honest and upright, straightforward and fair; but he also desires to have the money needed to make a good appearance in society; to realize his ideals is the way he sometimes puts it to himself. These social aspirations occasion the impressions and thoughts that, as opportunity offers, lead to attempts to secure their fulfilment. If the man is well-meaning, as most men are, he continues to justify his actions to himself on the ground that it is good business, is not illegal, or it will enable him to benefit his fellow men. Here, among others, belong those to whom the end justifies the means. They do not put it in that way. Indeed, they would deny such a utilitarian thought. But the good as these men see it, is the supreme thing and they are the ones appointed to achieve the result. Some of these are the strong characters who override law. They are the beneficent monarchs, either in reality or in thought, in their little realms.

In this group is the German Kaiser, who regards himself as the viceroy of God, and consequently incomparably superior to those of common clay unilluminated by the divine spark. In a speech at Koenigsberg, in 1910, he said: "Considering myself as the instrument of the Lord, without being misled by the views and opinions of the day, I go my way alone for the prosperity and peaceful development of our fatherland." And, again: "It is a tradition of our house that we, the Hohenzollerns, are appointed by God to govern and to lead the people whom it is given us

to rule, for their well-being and the advancement of their material and intellectual interests."

The Kaiser's attitude toward those who dare to disagree with him to whom God has transmitted his wisdom throws an illuminating side-light upon his self. Shortly after his accession "he was requested to sign a judicial sentence committing to prison one of his subjects who had been found guilty of hinting something disrespectful about his sovereign. William was genuinely amazed that such an unnatural crime could ever have been committed. He read and re-read the papers in the case with the closest attention; and finally said to the waiting official: 'It would seem that this man hitherto has not been a criminal —son of respectable parents, himself in a respectable walk of life, with a good education. And yet—how do you explain this?—this insult to the Anointed of the Lord? Strange! Strange!' "[1]

At another time, "after reading a speech of the Socialist leader, Bebel, containing some animadversions upon himself, he turned to the officer in attendance, with clouded brow and flashing eye, and remarked in a voice trembling with passion: 'And all this to *me!* To *me!* What is the country coming to?' "[2]

The Kaiser's two selves have been analyzed by one of his devoted admirers.[3] "He loves pomp, but his children are reared with bourgeois simplicity. . . . He is a mystic and a rationalist. . . . He is the legitimate offspring of Romanticism and Modernity. Of his two natures, one belongs to the twentieth century; one to the Middle Ages. One is despotic; one democratic. . . . One talks freely, perhaps too freely; one is silent as the sepulchre, and secretive as the Inquisition. . . . There are two Kaisers, both of whom labor for the benefit of the realm, each in his separate way, unconscious of heterogeneous intentions."

[1] *The Kaiser*, by Asa Don Dickinson, p. 165.
[2] *Op. cit.*, pp. 165 *f.*
[3] George Sylvester Viereck.

The following letter by William H. Seward also reveals the belief, though considerably diluted, that he alone discerned the right and had the wisdom and power to execute it. "The President is determined that he will have a compound Cabinet, and that it shall be peaceful, and even permanent. I was at one time on the point of refusing—nay, I did refuse, for a time, to hazard myself in the experiment. *But a distracted country appeared before me, and I withdrew from that position.* I believe that I can endure as much as anyone; *and maybe I can endure enough to make the experiment successful. At all events, I did not dare go home or to England, and leave the country to chance.*" [1]

Others, in whom the thought of benefiting those whom a wise Providence has put in their charge is not so strong, drift less consciously. Impressions affect them more easily. They are not so vociferous in proclaiming their virtues. But all must justify their actions to themselves. The tramp does it, and the bank president, who is laying away a snug little sum by means perhaps not altogether illegal, does it.

"Why should I work?" said a tramp to the writer. "If I work, I get only a living. My employer will keep the rest of what I produce, and I can get my living without working. Besides, I do not help to make others rich." Indeed, so human is this need for self-justification that men who talk continuously about uplifting others should be held under suspicion. They are talking to themselves quite as much as to others. They are trying to satisfy their consciences. They have not yet reached the stage of hypocrisy of which Samuel Butler spoke when he said that "no man is a great hypocrite until he has left off knowing that he is a hypocrite."

The environment includes much within its sphere of influence. Opinions, for example, are a part of it, and

[1] *Life of William H. Seward*, by Frederic Bancroft, vol. II, p. 45. (The italics are the present writer's.)

opinions are conspicuously temporal and local; and they constitute a by no means insignificant part of the "self" of acquaintances as we know them. If one who has always been admirably conventional and never indulged in the foolish practices of reflection so destructive to authority and respectability suddenly becomes an enthusiast for reform, he is said to be "beside himself." He has altered his personality so completely as to be no longer recognizable except through the face that clothes his thoughts. But opinions and beliefs are a matter of time and place. Like the cut of clothes they are settled by fashion. Some time ago the opinion of a large body of respectable men in England held that "in a free nation where slaves are not allowed of, the surest wealth consists in a multitude of laborious poor; for, besides that, they are the never-failing nursery of fleets and armies, without them there could be no enjoyment, and no product of any country could be valuable. To make the society happy and people easy under the meanest circumstances, it is requisite that great numbers should be ignorant as well as poor. Knowledge both enlarges and multiplies our desires, and the fewer things man wishes for, the more easily his necessity may be supplied."[1]

These men probably would not know themselves in their antiquated opinions, were they alive to-day; so vital a part of one's "self" are one's opinions. Yet men are not aware that there is anything peculiar and personal about their views. This is a phase of the psychology of the "self." One's opinions are so clearly true that they require no demonstration. Indeed, as that keen observer of human nature, Samuel Butler, once said: "We hold most strongly to what we are least capable of demonstrating." National customs and tastes offer a further illustration. They constitute an integral part of the self even though they are shared by one's fellow countrymen. According to

[1] Francis Adams, *History of the Elementary School Contest in England*, p. 46.

Robert Louis Stevenson, when the Prince of Wales's marriage was celebrated in Mentone by a dinner to the Mentonese, the dishes of the country were pronounced impossible by the British managers, and the guests were served with roast beef and plum-pudding and "no tomfoolery."

Allied to the alterations in personality through opinions are the changes that come from growth and development. Children have their peculiarities of self of which adults have no knowledge except as it is imparted by a sympathetic understanding of the ways of childhood. So strangely unreal to the mature are the fantastic day-dreams of youngsters that they seem like tales from *Gulliver's Travels* when related by Kenneth Grahame and Coningsby Dawson. Yet these imaginings make up a large part of the selves of children. They live the lives they picture, experience the adventures of their fancy, and fear the terrors conjured up by their instincts and forebodings.

"Funny thing," said Michael to Chator, in Compton Mackenzie's *Youth's Encounter*, "I have a queer feeling just after sunset, a sort of curious dampness inside me. Do you ever have it?"

"I only have it when you start me off," said Chator. "But it goes when we sing . . . anything holy."

"Yes, it does with me," Michael agreed dubiously. 'But if I drive it away it comes back in the middle of the night. I have all sorts of queer feelings. Sometimes I feel as if there wasn't any me at all, and I'm surprised to see a letter come addressed to me. But when I see a letter I've written, I'm still more surprised. Do you have that feeling? Then often I feel as if all we were doing or saying at a certain moment had been done or said before. Then at other times I have to hold on to a tree or hurt myself with something just to prove I'm there. And then sometimes I think nothing is impossible for me. I feel absolutely great as if I were Shakespeare. Do you ever have that feeling?"

This feeling of unreality is not so common with adults, but President Wilson is reported to have said, in his address at the National Press Club: "I really feel at times as if I were masquerading when I catch a picture of myself in some printed description. In between things that I have to do as a public officer, I never think of myself as the President of the United States, because I never have had any sense of being identified with that office."

Returning, however, to the feelings of childhood, a change comes, not suddenly but gradually. The nervous system needs time to develop. Functional connections between nerve-centres must be made. It is necessary to speak guardedly in ascribing definite changes to the nervous system as development proceeds, because known facts do not justify positive assertions. It is, however, a matter of general observation, as well as of scientific knowledge, that, in animals, growth in complexity of the nervous system keeps pace with increase of intelligence. Functional response is also elaborated. Animals low in the scale respond to fewer stimuli, and the excitations are interpreted in limited, definite ways. Far down the scale, movement in objects means but one thing. It is the stimulus for flight. Higher up, with dogs, for example, it may mean either to flee or approach, and with man the possible interpretations are much more numerous. The nervous receptors, in the course of evolution, have become adapted to one kind of stimulus, but the interpretation of this stimulus alters and becomes richer as the child grows into the adult. Time for maturation of nerve-elements is evidently needed. To what extent, if at all, new fibres appear after early childhood, is difficult to say. Certain investigators[1] seem to have found a new growth at about seventeen or eighteen years of age. At any rate, there is

[1] Kaes and Vulpius, *Wiener medizinische Wochenschrift*, vol. 45, pp. 1734 and 1770; *Münchener medizinische Wochenschrift*, vol. 43, p. 100; *Archiv für Psychiatrie und Nervenkrankheiten*, vol. 23, p. 775.

no doubt that new paths are opened and functional connections established. The nervous system of the boy of nine who, when his mother was dressing him in his best clothes for a trip on a steamboat, remarked sadly, "I thought we were going out to have a good time," is different from that of the same boy at fourteen who, for such an excursion, selects his necktie with scrupulous care.

Sometimes these changes in the self appear to come suddenly, but that is because whatever produces the alteration of personality of childhood and youth is going on below the surface. Observation usually detects the transition, but at times the adequate stimulus which would reveal the man in the youth has not been at hand. When, under these circumstances, the stimulus is applied abruptly, the unexpected reaction is startling both to the actor and the one who calls forth the response. Then the break seems to be sudden and, in a moment, the child becomes a man. Boys who have endured many minor indignities with childish submission flare up with the unexpected anger and resistance of maturity when the insult passes the limit of forbearance. Arnold Bennett gives a good illustration in a scene between Edwin and his father, Darius, in *Clayhanger*.

"Darius turned on him glaring: 'I'm trying to get at where ye got the brass from to buy them three books as I saw last night. Where *did* ye get it from? There's nowt wrong here, unless ye're a mighty lot cleverer than I take ye for. Where did ye get it from? Ye don't mean to tell me as ye saved it up!'

"Edwin had had some shocks in his life. This was the greatest. He could feel his cheeks and his hands growing dully hot, and his eyes smarting; and he was suddenly animated by an almost murderous hatred and an inexpressible disgust for his father, who in the grossness of his perceptions and his notions had imagined his son to be a thief. 'Loathsome beast!' he thought savagely. . . .

"'What do you mean by calling me a thief?' Edwin and Darius were equally startled by this speech. . . .

"'Let me come out!' Edwin shouted. They were very close together. Darius saw that his son's face was all drawn. Edwin snatched his hat off its hook, pushed violently past his father and, sticking his hands deep into his pocket, strode into the street."

Perhaps it is just as well to pass from early life to its close. This is an especially happy method in the present instance because a passage from the unfinished autobiography of Robert Louis Stevenson pictures in his inimitable way the terminus to which life sweeps us on. The selves of childhood and of youth have a common characteristic —the wide range of their possibilities, their uncertainty. Much is written to interpret the thoughts, emotions, and actions of children, but those of old age appear less difficult to describe. Probably this is because the course of life narrows as the end is approached. The destinations of different persons, so far as the characteristics of the self are concerned, bear a striking resemblance to one another, and, except in rare instances, the same comments would give an accurate description of each. Stevenson was not an old man at his death, but persistent ill health had much the same effect as advanced years. The sketch that he draws is the self of an old man touched with the quaint humor that the artist did not lose even when too weak to finish his drawing.

"I have the more interest in beginning these memoirs where and how I do, because I am living absolutely alone in San Francisco, and because from two years of anxiety and, according to the doctors, a touch of malaria, I may say I am almost changed into another character. After weeks in this city, I know only a few neighboring streets; I seem to be cured of my adventurous whims, and even of human curiosity; and am content to sit here by the fire and await the course of fortune. Indeed, I know myself

no longer; and as I am changed in heart, I hope I have the more chance to look back impartially on all that has come and gone heretofore."[1]

People calculate human equations from the conditions given in their own selves. This is true of all ages. One's ideas and classifications are the known factors and the points of departure. Those who hold views that radiate from a different centre are ex-centric. The self, with its organized beliefs, is so sufficient and compelling that one cannot conceive easily of other selves constructed out of different thoughts. Either such selves are made out of poor material or else they do not exist at all. In the latter case one spreads one's own self to cover the ideas and experiences of others. The best example that I have been able to find is an instance related by Nathaniel P. Langford in *Vigilante Days and Ways*.[2] Mr. Langford, in company with Samuel T. Hauser, afterward governor of Montana, was making a trip from Bannock to Salt Lake City in a Mormon "freighter." To while away the dreary monotony of the journey Langford recited to Hauser Milton's description of the meeting of Satan and Death at the Gates of Hell. The Mormon driver was observed to give close attention to the stirring passage, and soon after they had camped for the night he was overheard saying to a brother teamster: "I tell you, the youngest of those men in my wagon, the one that always carries that double-barrelled shotgun, is a powerful talker. I heard him harangue t'other one today for half an hour, and he talked mighty fine. He can overlay Orson Hyde and Parley Pratt, both, and I rather think it would trouble Brigham Young to say nicer things. And, after all, he had pretty much the same ideas that we have."

Curious ways the self has! Strange inconsistencies! Our town or city is so much a part of our selves that, though we criticise it severely to one another, we become

[1] *The Cornhill Booklet*, vol. 4, p. 55. [2] Vol. 2, p. 13.

indignant the moment an outsider says anything against it. Our friends, also, are a part of our selves. If they are not appreciated by others it is a personal matter. Indeed, we deny and justify to others the very faults that are admitted in private.

The members of our family, of course, are an integral part of our self. And here a curious attitude sometimes discloses itself. It is a feeling of resentment and, at times, of jealousy at the regard or affection shown by another for a son or brother. Of course one wants one's relatives appreciated, but intimacy is resented, not infrequently, as a curtailment of one's "self." Stranger still, when, though the intimacy is unpleasant for social reasons, and one is anxious that it cease, denial of affection may, again, arouse indignation. It is a reflection on that part of one's "self" represented by the members of one's family. For how can others fail to share one's own regard? Yet indifference is desired. Galsworthy gives a splendid illustration in his *Country House.*

Mrs. Pendyce was much disturbed over the attention which her son George was showing Mrs. Bellew. She was sure that Mrs. Bellew was to blame—the other one always is—and she called upon her to say that the friendly relations must end. But Mrs. Bellew's frank confession that she was tired of George and did not love him, was a shock and, because of the impossibility of such indifference to her son it aroused Mrs. Pendyce's anger.

"Mrs. Pendyce stammered:

"'I don't understand.'

"Mrs. Bellew looked her in the face and smiled; and as she smiled she seemed to become a little coarser.

"'Well, I think it's quite time you did. I don't love your son. I did once, but I don't now. I told him so yesterday, once for all.'

"Mrs. Pendyce heard these words, which made so vast, so wonderful a difference—words which should have been

like water in a wilderness—with a sort of horror, and all her spirit flamed up into her eyes.

"'You don't love him?' she cried.

"She felt only a blind sense of insult and affront.

"This woman tire of George! Tire of her son! She looked at Mrs. Bellew, on whose face was a kind inquisitive compassion, with eyes that had never before held hatred.

"'You have tired of him? You have given him up? Then the sooner I go to him the better! Give me the address of his rooms, please.'"

Intentional adoption of a personality for provisional effect is, of course, common. Such play-acting multiplies the self—at least there exists a real and a seeming self. But this stage effect usually involves a partial self-deception. Indeed, the ease with which man deceives himself is an interesting human trait. By feigning what they are not, people come to acquire an assurance of being what they assume. They act the part and through deceiving themselves think that they deceive others. Pretense of youthfulness, for example, by women advanced in years is a never-failing source of amusement to those who see below the surface of the color-mixture. At times this self-deception takes another form, as in the case of a Pittsburg congregation whose pastor requested the women to remove their hats so as not to obstruct the view of those in the rear. Only a few complied. But the pastor, knowing something of human psychology, quickly added: "My request, of course, does not apply to elderly ladies. I hope, however, that the young women will do me the favor." In a moment every woman in the church had removed her hat.

This adoption of a make-believe personality originates in the human belief that others do not see what one tries to hide from oneself. But it is interesting to observe that it is also an adaptation to the tendency to accept a man at his face value—at his own appraisal of himself. This

is true, of course, only of certain individuals. It depends upon the skill with which the man carries the part. Either he must be thoroughly convinced that he is the character which he assumes or else he must be a consummate actor. Suggestion plays its part here, and the carrying power of a suggestion is largely determined by the confidence and self-assurance of the performer. Nevertheless, the number who succeed is sufficiently large to establish a rule of action for social and business charlatans. The ease with which bankers are deceived by personal appearance and demeanor is often a matter of comment. Yet it is a part of their training to assume that a stranger is not what he represents himself to be.

Which is the true self in this contest of personalities? It is not always easy to say. The more worldly self, when in power, gloats over its conquests, and the more spiritual, in turn, laments its weakness. A man may have failed to realize his higher aspirations and have yielded to the lower impulses in his efforts to get on in the world. Every one knows of ambulance-chasers and quacks who started out with good intentions. Conversation with a number of these has convinced the writer that some of them, at any rate, are not altogether at peace of mind. A view of the reverse side of the picture is not so easily obtained, because it is much easier to fall than to rise, but a number of years ago a physician began deliberately as an advertising quack, became disgusted with himself, dropped his work, graduated from a high-grade medical school, and is now one of the leading surgeons of his State.

We have been trying to discover the motives underlying variations of the self—to indicate a few of the explanatory influences, and we have found them numerous and, in many instances, obscure. Man seems to be a reservoir of possibilities that is drawn upon by the environment. Of course every one has his individual limitations, but within his range the combination of qualities that make him what

he is seems countless. "I think thoughts worth while when in his presence," is not an uncommon remark of those who usually think in terms of conventional ecstasy. In society it is difficult to recognize the stern man of affairs or the thoughtful moralist. All of what a recent writer has called "instinctive idiocies" comes to the surface. Here the philosopher revels in verbal luxury, and the man who, among the thoughtful, is noted for the prominence of his imperceptions draws on the unearned increment of his reputation. Among roués, on the other hand, many a man soaked in respectability and yellow with the golden pollen of countless virtues becomes one of "the boys." His moral principles, swollen almost to bursting, are temporarily laid aside to be brought out again at a favorable juncture of the stars, when they will win creditable admiration.

We have been considering the varying selves as they occur in every-day life. An instance has recently been made known, however, that is of special interest because it is on the border-line between the normal variations commonly observed and the abnormal. William Sharp's two selves have been described in the absorbingly interesting book by his wife.[1] The condition is unusual for adults, but in no other sense abnormal; and the vivid reality of his second self is not uncommon in children.[2]

With William Sharp, the moral or intellectual revolt which we have observed in some of the other cases did not exist. His other self was rather the cry of hunger from a starved soul. How real this alternating personality was may be gathered from a letter of Mr. Yeats.[3] "Fiona Macleod was a secondary personality—as distinct a secondary personality as those one reads about in books of psychical research. At times he (W. S.) was really to all intents and purposes a different being." He would "come

[1] *William Sharp: A Memoir*, by Elizabeth Sharp.
[2] See *Una Mary*, by Una Hunt. [3] Quoted by Mrs. Sharp.

and sit down by my fireside and talk, and I believe that when 'Fiona Macleod' left the house he would have no recollection of what he had been saying to me."

The vivid earnestness of Fiona evidently led Mr. Yeats into the error of thinking that amnesia existed between the two personalities. As a matter of fact this is not necessary even in abnormal cases. "It is true, as I have said," writes his wife, "that William Sharp seemed a different person when the Fiona mood was on him; but that he had no recollection of what was said in that mood was not the case. That he did not understand it, is true. For that mood could not be commanded at will. Different influences awakened it, and its duration depended largely on environment. 'W. S.' could set himself deliberately to work normally, and was, so far, master of his mind. But for the expression of the 'F. M.' self he had to wait upon mood, or seek conditions to induce it."

This was not an attempt on the part of Sharp to write on different topics. Fiona Macleod was not a pseudonym. She was a personality. "My truest self," he wrote in a letter, "the self who is below all other selves, and my most intimate life and joys and sufferings, thoughts, emotions and dreams, must find expression, yet can not, save in this hidden way." The Sharp personality seems to have been an unnatural growth forced to develop by severe economic conditions. William Sharp's style was calm, uninspired, critical, prosy; while Fiona Macleod wrote poetic prose in an extremely imaginative style. Descriptions of nature, full of color, with spiritual phrases, abound. Her themes were the life, customs, and superstitions of the Highlands, while Sharp wrote chiefly biographies and reviews.

From the time when "he stilled the critical, intellectual mood of William Sharp to give play to the development of this new-found expression of subtler emotions, toward which he had been moving with all the ardor of his nature . . . there was a continual play of the two forces in him, or of

the two sides of his nature: of the intellectually observant, reasoning mind—the actor, and of the intuitively observant, spiritual mind—the dreamer, which differentiated more and more one from the other, and required different conditions, different environment, different stimuli, until he seemed to be two personalities in one. . . . He was wont to say: 'Should the secret be found out, Fiona dies.'"

Fiona seems to have had a life of growth and development altogether independent of William Sharp, passing, as Mrs. Sharp puts it, from youth in *Pharais* and *The Mountain Lovers* through maturity in *The Barbaric Tales and Tragic Romances* "to the greater serenity of later contemplative life in *The Divine Adventure*, *The Winged Destiny*, and *Where the Forest Murmurs*." At one time he wrote: "Sometimes I am tempted to believe I am half a woman."

But each of his two natures had its own needs, desires, interests, and friends. For a time there was such opposition between them that it was difficult for him to adjust his life to the two conditions which were equally imperative in their demands. "His preference, naturally, was for the intimate creative work which he knew grew out of his inner self; though the exigencies of life, his dependence on his pen for his livelihood—and, moreover, the keen, active interest 'William Sharp' took in all the movements of the day, literary and political, at home and abroad—required of him a great amount of applied study and work. . . . The needs of each were not always harmonious one with the other, but created a complex condition that led to a severe nervous collapse."

If we look for the source of this dual personality in Sharp, we find its beginning, at any rate, in early childhood. He was an extremely imaginative child, but he was also a real boy who loved the activities and adventures that appeal to boys. "About the dream and vision side of his life," his biographer says, "he learned early to be silent.

He soon realized that his playmates understood nothing of the confused memories of previous lives that haunted him, and from which he drew materials to weave into stories for his schoolfellows in the dormitory at night. To his surprise he found they saw none of the denizens of the other worlds—tree spirits and nature spirits, great and small—so familiar to him, and who he imagined must be as obvious to others as to himself."

"In surveying the dual life as a whole," says his wife, "I have seen how from the early partially realized twinship, 'W. S.' was the first to go adventuring and find himself, while his twin 'F. M.' remained passive, or a separate self. When 'she' awoke to active consciousness 'she' became the deeper, the more impelling, the more essential factor. By reason of this severance, and of the acute conflict that resulted therefrom, the flaming of the dual life became so fierce that 'Wilfion'—as I named the inner and third self that lay behind that dual expression—realized the imperativeness of getting control over his two separated selves and of bringing them into some kind of conscious harmony."

Yet, notwithstanding this conflict, each personality was complete in itself. Each preserved its own peculiar characteristics. There was no interference or confusion; no exchange or overlapping of natures. This consistency of Fiona Macleod is important. It is what makes her a personality. Consistency in matters necessary for identification may be assumed and maintained for a short time. But it finally breaks down. There have been fairly well-authenticated instances of the substitution of a spurious "long-lost" son, who played his part successfully for a brief period. A somewhat similar deception is illustrated by men who seek to justify a reprehensible act when they have had time to prepare their defense, and also by false alibis. But in all such cases something is forgotten; the stories do not fit, and inconsistencies are soon discovered.

It is impossible to feign successfully what one is not, to play intentionally the part of two widely varying characters. Habits of thought and action are too controlling, too compelling. A man cannot be constantly alert. The strain on the attention is too great, and it lapses before he is aware of the change. So one is unable to be continuously mindful of what one says and does. Impostors are surprised out of their security. Though it is a well-known method of lawyers to lead a witness peacefully along until he feels mentally comfortable, the attention meanwhile losing its edge through adaptation to the feeling of satisfaction with the answers, and then suddenly, when he is off his guard, to spring a question, the plan usually succeeds. In the more common matters of life this variation in the efficiency of attention is observed in the difficulties of conversation when one wishes to make a good impression. How often one makes remarks which one would gladly recall. The usual excuse is that we were not "ourselves." The very attempt to produce a favorable effect is disturbing. It is like walking. What does not follow automatically reveals its awkwardness. Some one has said that nothing can replace wisdom, though silence is the best substitute. But in playing a part one cannot be always silent.

The consistency of "Fiona Macleod," then, is the most important bit of evidence in establishing her claim to personality. Her interests, her feelings and emotions, her thoughts and style are too diametrically opposed to those of Sharp to permit the assumption of intentional adoption. His early topics and mode of treatment were the surface response to the demands of the reading public as he interpretated them. Dependent, as he was, upon his pen, literary criticism, for which he had taste and talent, offered the quickest and surest way of earning a living. But there was a deeper self, a personality suppressed for a time by his economic and social conditions. Had this

submerged self been less real, less vital, it might never have risen to the surface. But it was more truly himself than the austere critic that represented William Sharp. So it asserted itself and finally became the controlling force of his life. That memory, at times, seemed almost discontinuous indicates that we have here a border-line case between the common variations in the self and the condition of double personality which is so far from the line as to be called abnormal.

Returning now to the more common alterations of the self, the illustrations have disclosed startling variations in the character and purposes of the same individual. There is always rivalry and conflict between the different selves. Now one gains control, and now the other. It is not always possible to say which line of conduct most truly represents the man. In some it is the baser acts, and the nobler deeds are done with conscious purpose to maintain a social position. Fortunately, such men are rare. Most people have good intentions, and their failures are due to moral weakness influenced by social or psychological causes. Man desires, at least, a satisfying unity in his life. Every one likes to feel that he is true to his ideals; and the struggle to secure this feeling is seen in the excuses which are made for deviation from the higher code of action. Consequently, man is prone to deceive himself with the conviction that his acts are justifiable because others do them, or because they will enable him to do counterbalancing good in other ways, or else he drifts and finds excuses afterward. These by no means exhaust the categories. Man's actions are exceedingly complex, as much more complex than those of the lower animals as is his nervous system, and for just that reason.

The action of animals is usually predictable. It always is to one who knows their ways. They are severely consistent. Inconsistency, curiously enough, comes with development, at least with a certain stage of development.

Perhaps this is due to the fact that development means, among other things, multiplying ways of reacting to what is superficially the same situation. Man sees a greater number of possible reactions—more ways of behaving—with reference to external situations than do the lower animals. Primitive man, also, was consistent until he learned inconsistency from contact with his civilized teacher. The larger number of possible responses are confusing. Putting them in order requires the organization of information and moral principles, as well as insight into the effect of acts; and thinking in terms of cause and effect is a comparatively new instrument of behavior.

The man of good intentions, however, who yields to moral weakness has moments of keen remorse. But the effect is momentary. He repents and sins again. Some people have the repentance habit. They gain a certain solace and even joy from the excitement. It is a sort of emotional debauchery in which they indulge periodically, just as others drown their sorrow in drink. This is one of the ways in which the emotions ooze out ineffectually instead of producing action which is the phylogenetic justification for their existence. In time, inaction, with such people, becomes a fixed mode of behavior. They are continually making resolutions which are never carried out.

This feeling of remorse easily leads to the self-deception to which, as we have said, man is prone. He is much more naïve in this than are those who observe him. He does not know that he is practising self-deception though he may have observed this trait in others. This, again, is human—seeing quite clearly in acquaintances what one does not discover in oneself, though it may be patent to all the rest of the world. It illustrates a certain human blindness.

Finally, there should be a selection of the self to which we yield submission. "Not that I would not, if I could,"

says James, "be both handsome and fat and well dressed, and a great athlete, and make a million a year, be a wit, a *bon vivant*, and a lady-killer, as well as a philosopher; a philanthropist, statesman, warrior, and African explorer, as well as a 'tone-poet' and saint. But the thing is impossible. The millionaire's work would run counter to the saint's; the *bon vivant* and the philanthropist would trip each other up; the philosopher and the lady-killer could not well keep house in the same tenement of clay." One or the other will finally dominate. The question is, Which?

CHAPTER X

THE PSYCHOLOGY OF DIGESTION

"It looks so good that it makes my mouth water" is a common saying; and it is not merely a figure of speech. The mouth actually does water at the sight of appetizing food. That is, the flow of saliva begins. Now, since the food has not been tasted the cause of this flow must be altogether different from that which stimulates secretion when food is actually eaten. Evidently, the mind is at work here, with its expectation of approaching pleasure; and this anticipation is one of the psychical contributions to digestion. Its effect, in the feeling of the mouth when appetizing food is offered, is a matter of common experience. It is not so generally known, however, that visions of pleasant eating also make the stomach "water."

As long ago as 1852 two investigators[1] noticed that the sight and smell of food started gastric secretion in the stomach of a hungry dog, and twenty-six years later Richet reported[2] evidence of a generous flow of gastric juice in one of his patients when such substances as sugar or lemon-juice were chewed or tasted, though the act of swallowing could not be completed on account of a closed œsophagus. But the importance of these observations was not understood at the time, and the investigations were unproductive. More recently, however, a Russian physiologist, Pavlov, repeated the experiments on dogs, under improved conditions, and demonstrated the significance for digestion of the psychical factor, desire or appetite.

[1] F. Bidder and C. Schmidt, *Die Verdauungssäfte und der Stoffwechsel*, Leipzig, 1852.

[2] *Journal de l'Anatomie et de la Physiologie*, vol. 14, p. 170.

But let us begin with the first stage of digestion, namely, with the saliva, and see what this mental co-operation means. Of course when food, and especially dry food, is put into the mouth saliva begins to flow. The advantage of this is to moisten the food and render easier the act of swallowing. Animals deprived of the parotid saliva swallow dry food only with the greatest difficulty. In addition, the saliva dissolves the soluble constituents of food, making them perceptible to the nerves of taste, and, in certain articles of diet, it starts the digestive process. Now Pavlov has shown experimentally that it is not necessary for food to be put into the mouth to excite the salivary reflex. All that is needed with a hungry dog is to direct his attention to the food. Then the saliva begins to flow. As might be expected, the success of the experiment depends upon the anticipation elicited by the sight of what is offered. If the animal has found from past experience that it tastes good, the glands begin at once to pour out their secretion abundantly. On the other hand, if previous experience has shown that the substance offered will not taste good, no saliva is secreted. "In the course of our experiments," says Pavlov,[1] "it appeared that all the phenomena of adaptation which we saw in the salivary glands under physiological conditions, such, for instance, as the introduction of the stimulating substances into the buccal cavity, reappeared in exactly the same manner under the influence of *psychological* conditions—that is to say, when we merely drew the animal's attention to the substances in question. Thus, when we pretended to throw pebbles into the dog's mouth, or to cast in sand, or to pour in something disagreeable, or, finally, when we offered it this or that kind of food, a secretion either immediately appeared or it did not appear, in accordance with the properties of the substance which we had previously seen

[1] *The Work of the Digestive Glands*, translated by W. H. Thompson, 1902, p. 152.

to regulate the quantity and nature of the juice when *physiologically* excited to flow." In other words, expectation of a pleasant taste plays an important rôle in promoting the flow of saliva and, consequently, in furthering all of the phases of digestion with which saliva is concerned.

But anticipation reaches far beyond the sight or smell of pleasant food. The food itself need not be present. Anything that is regularly connected with it at an enjoyable meal will be sufficient to stimulate the reflex. Whatever has been associated with the substances that physiologically excite the salivary secretion may arouse it psychologically. The attendant who feeds the animals, his footsteps, taking the dog into the room where he is wont to be fed, the vessel usually containing the food, and the furniture of the room, any one of these will be sufficient to produce the flow. Curiously enough, substances which stimulate the reflex in a purely mechanical way, irrespective of enjoyment, have the same effect—the sight of the bottle containing the acid that starts the secretion mechanically, for example. If the acid is dark, then water in the bottle of the same color as the acid will produce a like effect.[1] Since it is the color that exerts the influence, dogs, according to Pavlov, distinguish certain colors. If an illuminated circle be shown with food the circle alone will finally excite the reflex. Since an illuminated quadrilateral does not have this effect, dogs appear to distinguish between these figures. "If a definite musical note be repeatedly sounded in conjunction with the exhibition of meat-powder, after a time the sound of the note alone is effective. Similarly with the exhibition of a brilliant color."[2] Since a difference of a quarter of a tone produces no result, the dog seems to make this distinction. Indeed,

[1] A. Meisl, *Journal für Psychologie und Neurologie*, vol. 6, p. 192; *Wien. kl. Rundschau*, vol. 17, p. 375. W. Nicolai, *Journal für Psychologie und Neurologie*, vol. 10, p. 1.

[2] Pavlov, *op. cit.*, p. 85.

Pavlov found that this animal can be so trained that his salivary glands will respond to any excitation by associating the stimulus with food that gives pleasure when eaten. "Any ocular stimulus, any desired sound, any odor that might be selected, and the stimulation of any part of the skin, either by mechanical means or by the application of heat or cold, have in our hands never failed to stimulate the salivary glands, although they were all of them at one time supposed to be insufficient for such a purpose. This was accomplished by applying these stimuli simultaneously with the action of the salivary glands, this action having been evolved by giving certain kinds of food, or by forcing certain substances into the dog's mouth." [1]

In considering the "psychic" flow of saliva—which means its secretion before the food is actually tasted—we must remember that it occurs only by reason of association with the physiological response. The latter has its explanation in the evolutionary biological history of the species or race. The psychological reaction occurs because of a relationship established between the excitation of the salivary reflex and certain definite perceptions. These perceptions finally come to represent the cause of the excitation. This connection between the salivary reflex and objects wholly unessential to gratification of the appetite, as, for example, a musical note, is a temporary association. It was formed by the simultaneous occurrence of, first, a taste so pleasant as to excite the salivary reflex, and, second, of another perception wholly unessential to the satisfying quality of the first, but nevertheless made into an integral part of it by the conjunction in time of the two perceptions. Repetition of these simultaneous perceptions strengthens the union between them and soon the sign is identical with the food. An unessential, perhaps wholly accidental, property of the object has thus

[1] *Ergebnisse der Physiologie*, vol. 3, 1904, 1 Abteil, p. 177. Huxley Lecture, *British Medical Journal*, 1906, vol. 2, p. 871.

become, so far as the animal is concerned, the object itself. The visual, auditory, or olfactory perception of these accidental qualities of substances pleasant to the taste influences the salivary centre through the various and circuitous nerve-paths which lead from the several sense-organs. Undoubtedly, these perceptions reinforce one another with a strength approximately proportional to their associative bond. "It would appear," Pavlov thinks, "as if the salivary centre, when thrown into action by the simple reflex, becomes a point of attraction for influences from all organs and regions of the body specifically excited by other qualities of the object. . . . The establishment in this way of temporary relationship between external objects and important life processes, as well as the ease with which they are lost, are matters of very considerable value to the organism. By such means functional activity is better adapted to the surrounding conditions, while, on the other hand, readjustment is readily permitted when the conditions alter." [1]

Illustrations of the way in which these associations aid functional activity and promote the adjustment of the animals to their surroundings readily suggest themselves. The association of food with a region, the connection in this case being between the food and what may be called the furnishings of the country—the trees, contour of the land, etc.—and association of the locality with the call of food-animals are cases in point. In the same way danger may be associated with a given territory. As before, the association may be based upon the characteristics of the region, or upon one or more animals which are feared. Avoidance of delicious bits in traps because of incidental connection with odors of human hands, or with certain appearances, offers illustrations of olfactory and visual associations. Trappers seek to avoid such associations by removing odors, and by giving the location of their traps

[1] *Op. cit.*, p. 86.

a natural look with shrubbery and other devices. This repellent association may even exist between a favorite food-animal and a certain region, thereby serving as a protection during a transitory period. As an instance of readjustment, this condition may be a passing phase due to the temporary presence or hostility of dangerous animals, as of man. When the cause of avoiding the region is removed, as in the closed season, the animals in whom the repellent association existed return. This is seen to-day, again, when deer, squirrels, and other animals desert a section of country, but return later after man has come to find pleasure in their presence instead of hunting and killing them.

It may be well, in passing, to observe that these associations of which we have been speaking—chance connections between objects or qualities of objects—are fundamentally of the same sort as perverted associations. In the latter case perceptions are overemphasized and applied indiscriminately. The feeling for proportion is lost. When carried over into the realm of thought, these incidental and accidental associations may establish habit-psychoses the periodic recurrence of which produces obsessions, which are meaningless except in the overwrought mental complex of their possessor. From these "imperative" or "fixed" ideas arises that state of mind which characterizes fanatics—the men who seek to square the circle or to cure all social ills by their own special brand of religious elixir. It should be added that fanaticism is a matter of degree. To the extent to which a man ties himself to one idea and allows it to become "fixed," he approaches fanaticism. When the idea becomes dominant such a person sees the world of thought in a perverted form because his ruling idea is always the centre of reference, and no one idea, however much truth it may contain, can house the explanation of any human problem. Human behavior—and consequently the world of action—is too complex for so

simple a solution. The "fixed" idea prevents its possessor from understanding other ideas because thought relationships are disturbed. In the past, religion has admittedly furnished the largest number of this particular aberrant type, but to-day anti-vivisectionists, anti-inoculationists, and pacifists, to mention only a few, indicate a rather alarming widening of the range of association-psychoses.

These associations, like those of which we have been speaking in the lower animals, are incidental in the sense that they are not a necessary part of the conditions or circumstances. If they arouse agitating emotions they interrupt certain physiological processes in the same way as we shall find anger or fear does when an animal faces opposition or danger. Anything which prevents a person from seeing things in their right proportion disturbs digestion to the extent to which it brings him in conflict with others less insane than himself. Only that serenity in error which admits no doubts, and consequently allows no conflict, is compatible with a healthy digestion. Consequently, if one is to contend one should be quite certain that the argument is worth gastric disturbance. In any individual case, however, this decision revolves on the "imperative" idea, and so the vicious circle continues its satisfied whirl. But to return to our theme.

We have seen that anticipation of an enjoyable meal not only excites the salivary glands to action, but that this expectation of pleasure is carried over to whatever is associated with the food that promises pleasure. On the other hand, the reflex does not respond to food or other substances which do not awaken expectations of enjoyable sensations. Evidently, this physiological process is not purely mechanical. It is not set off by merely putting something into the mouth. Even food does not always accomplish the complete result. It depends on the attitude of the animal or man toward the food. A mental factor is involved.

But in addition to the inertness of certain substances, which may or may not be food, interference with the secretion of saliva may also be set up. It has long been known that in certain mental states the saliva refuses to flow. The dry mouth of the inexperienced public speaker during the "watchful waiting" to hear his name called is an illustration. This psychological effect of suspense has been utilized by primitive people as a test of guilt. In India those suspected of a crime were compelled to chew consecrated rice for a short time, and then to eject it for judicial examination. The one who ejected it dry was declared guilty. As in many other primitive ordeals and ceremonies the gods received credit for a psychological principle which has slowly proved itself in the experience of the race. Anxiety, worry, fear, and anger, all stop the secretion of saliva. If an angry person at dinner will turn psychological investigator for a moment he will notice how difficult it is to swallow his food. It is too dry. In fear, again, one of the physical characteristics is a parched mouth and throat. It is clear then that the mental state profoundly influences the secretion of saliva. There are, however, interferences of another sort.

At the sight of bread the salivary reflex is excited. Now, however, after a generous flow has started, Pavlov observed that if flesh is shown to the dog the secretion of saliva ceases. The sight of flesh has, in some way, inhibited the salivary response to bread. It is not merely the greater desire of the dog for flesh that causes the inhibition, for the secretion started at the sight of bread is also quickly stopped if the animal sees another dog eating the same food. It is impossible to be very definite in accounting for this inhibition. The explanation must be by analogy, which is never quite satisfactory. We know that, at a given moment, only a certain amount of nervous energy is available, and that the nerve impulses are likely to take the line of greatest activity, which for the time is the

path of least resistance. In both of these cases a motor centre is excited. This is shown in the first instance by the vigorous efforts to obtain the flesh, and in the second, by the efforts to reach the other dog and take the bread from him. Action, therefore, is paramount, and the nervous impulses are directed toward making it as vigorous and efficient as possible. It is much the same as when an animal fights or flees. All of the available energy is directed to vigorous muscular activity. Digestion, and glandular action concerned with it, must wait. The muscles call for blood and nervous energy that they may perform their function. In an emergency the organs needed to meet the situation are the ones that the blood and nervous discharges hurry to assist, and so other bodily activities yield to their demand. Consequently, other organs are drained. The muscles, directed by the motor area, are the centre of influence, and reflex reactions which contribute nothing to their strength or skill are delayed.

Briefly summarizing the results of these investigations, experiments have shown that the salivary reflex is set in motion by a psychical factor. The anticipated pleasure of the meal presses the button that starts the physiological machinery. Enjoyable surroundings promote this pleasure by creating a mental attitude of expectancy; and when once the appetite flow begins the physiological processes continue the secretory activity with increasing vigor. But interferences may occur to delay or inhibit the process.

We turn now to the psychic effect upon the flow of gastric juice. Pavlov divided the œsophagus of a dog and exposed the two ends. An opening was then made into the stomach. The dog could now be fed either through the neck opening of the œsophagus leading into the stomach, and still connected with it, or through the direct opening into the stomach (gastric fistula). It could also be fed as usual through the mouth, but when this food was swallowed it fell out of the exposed end of the œsophagus in the neck

instead of passing into the stomach. In this way all the pleasures of eating could be experienced and their effect upon the flow of gastric juice accurately determined. Since the food taken through the mouth did not reach the stomach, whatever gastric juice appeared would be the result of psychic influences alone. The effect of this "sham feeding," the pleasant sensations of the enjoyable taste, are evidently transmitted to the gastric glands by nerve-paths. "Sham feeding" has the advantage also of never satisfying the animal. He can go on eating indefinitely without feeling "full." So the persistence of the psychic effect can be measured. One dog continued eating for five or six hours, enjoying every minute of the period, and in that time 700 c.c. of the purest gastric juice were secreted, though not a particle of food had reached the stomach. This dog was contented and happy. Indeed, the comfortable feeling that comes from well-being is essential to the success of the experiments, and some of the dogs lived in ease and comfort for several years.

Pavlov also produced a miniature stomach, a *cul-de-sac*, at the cardiac end of the stomach, and proved that the gastric juice secreted in this small stomach was in all respects representative of that produced in the entire organ. He was thus enabled to estimate quite accurately the quantity and quality of gastric juice secreted as the result of different methods of feeding. He observed further the changes produced in the gastric juice by varying sorts of food. All of these experiments included, among other influences, the appetite—a psychic factor.

When Pavlov fed a dog with divided œsophagus through the mouth he ate greedily but, of course, the food that he swallowed passed out at the opening in the neck. Yet pure gastric juice at once made its appearance and steadily increased in quantity, continuing to flow as long as the animal was "fed." This secretion produced by psychic influences Pavlov called "psychic" or "appetite" juice.

The stimulation of the nerves of the gastric glands by the act of chewing and swallowing depends then, to a large extent, upon a psychic factor which starts a physiological process. The physiological activity underlying digestion is thus shown to be a very complex reflex act, involving the co-operation of a number of organic processes, some of which are psychological. The dog with divided œsophagus not only imagines that he is eating food, but, so far as he knows, he actually eats it. There is no disappointment in what he is doing because the food tastes good, and he swallows it. So he eats greedily, and the gastric juice flows abundantly.

The evolutionary significance of this is clear. Getting food is not merely a physiological matter. Desire, anticipation, selection, judgment, and the will to obtain, all play their rôle. As with the salivary glands, the first and strongest excitation for the gastric reflex is the sight, or smell, and then the taste. As an illustration, one of Pavlov's dogs was excited by showing him meat for an hour and a half. He was then given a sham meal. The gastric secretion obtained during the hour and a half sight of the meat was somewhat greater than that produced by sham feeding.

Taste, however, is of immense importance for gastric secretion. Consequently, emotional states stimulating to the salivary reflex should prevail at meals, for food can be tasted only when dissolved in the mouth. Only by this means can it be brought in solution into contact with the taste organs. The pleasant taste increases the effect of the agreeable feelings aroused by the sight of the food. Either sight or taste may start the "psychic" juice, but both together will greatly enlarge the flow. Emotional disturbances, on the other hand, that inhibit the salivary reflex check the gastric secretion indirectly by blunting the taste. The effect is, therefore, cumulative from both points of view. The emotional conditions unite both re-

flexes, in the one case to aid digestion, and, in the other, to check or stop the process.

Delicate response to stimulation of those organs that sense from a distance is not sufficient for the preservation of the species. There must be some point to the response, something that gives it meaning in relation to the organism, something that drives the animal irresistibly in pursuit of that which promises pleasure to the taste. And this impulse is the craving of a hungry animal for food. The psychical aspect of this longing is the desire and expectation awakened through the excitation of the distance receptors, and joined with this anticipation is the physiological preparation of the stomach to receive the food—the reflex response of the gastric glands. "Thus appetite," as Pavlov says, "so important to life and so full of mystery to science, here at length assumes a tangible existence, and becomes transformed from a subjective sensation into a concrete factor within reach of physiological investigation."

We found in discussing the psychical response of the salivary reflex that any object or action regularly connected with obtaining pleasant-tasting food is soon associated in the mind of the animal with the meal itself. The same observation was made on the secretion of gastric juice. If the dog was hungry the appearance of the attendant, even his footsteps, and any movement that he was wont to make when giving food, were sufficient to excite the gastric glands.

Pavlov's observations on dogs have been verified by several investigators[1] on human beings, at least so far as the effect of tasting pleasant substances is concerned. Carlson, however, found[2] a relatively slight and incon-

[1] Adolf Bickel and K. Sasaki, *Deutsche medizinische Wochenschrift*, vol. 31, p. 1829. A. Cade et A. Latarjet, *Journal de Physiologie et Pathologie Général*, vol. 7, p. 221. A. F. Hornborg, *Skandinavisches Archiv für Physiologie*, vol. 15, p. 209.

[2] *The Control of Hunger in Health and Disease*, by Anton Julius Carlson, pp. 237 *f.*

stant secretion from merely seeing, smelling, or thinking of food in the man with whom he experimented. But Pavlov observed great variation in this respect in his dogs and, as Carlson suggests, the man whom he himself tested may belong "to the group of individuals in whom the taste of food is the all-important factor in the psychic secretion of gastric juice." There is, however, another element which must not be overlooked, and which may account for the failure of Carlson's man to secrete gastric juice at the sight and smell of food. As we shall see, the psychic-secretory mechanism is especially sensitive to inhibitory influences, and it is quite possible that the routine collection of the juice may, by the very disagreeableness of the experimental procedure and irritation at delay, set up inhibitory processes. Carlson himself suggests this in the case of his patient. "It is probable," he says, "that under these conditions the primary and normal effects of seeing and smelling the food are inhibited by the consciousness of the experiment, or possibly his main interest was not in the food, but the expiration of the experiment, so that he might partake of the food." Psychic influence is emphasized by Carlson in explaining the findings of several investigators, which he was unable to confirm. In referring to the observations of Kaznelson and Bickel, for example, that any olfactory stimulation induced secretion of gastric juice in the resting stomach, he says: "It is possible that in this young woman every gustatory and olfactory stimulus when manipulated by the investigators led to thoughts of food through idea associations."[1] Among the confirmatory evidence of the influence of thinking about eating is the observation of Cade and Latarjet[2] that gastric juice was secreted in a young woman when her favorite food was the subject of conversation.

Whatever individual differences there may be in the effect of thinking about food, there is very general agree-

[1] *Op. cit.*, p. 239. [2] *Op. cit.*

ment regarding the influence of taste. Gastric juice was secreted in the stomach of a boy who came under Hornborg's care when he chewed agreeable food, but rubber brought no secretory response. This has been verified by Carlson. "The mere act of chewing indifferent substances and the stimulation of nerve-endings in the mouth by substances other than those directly related to food cause no secretion of gastric juice."[1] Evidently, it is a matter of taste and enjoyment, and not merely of having something in the mouth or of chewing. Carlson found that "the secretion is proportional to the palatability of the food"; and he is of the opinion that "the significant appetite secretion in man is that induced by tasting and chewing good food."

In man, then, as in the lower animals investigated, the pleasurable sensations caused by the smell, taste, or thought of enjoyable food serve as a stimulus to the gastric reflex. We are therefore justified in saying with Pavlov "that appetite is the first and most potent exciter of the secretory nerves of the stomach, a factor which embodies in itself something able to compel the empty stomach of the dog during the fictitious meal to secrete large quantities of the strongest juice. A good appetite in eating gives origin at the outset to a vigorous secretion of the most active juice; where there is no appetite this is absent."

We cannot, however, agree with Pavlov when he says that "to restore appetite to a man means to provide him with a large stock of gastric juice wherewith to begin the digestion of a meal." Rather should we say that appetite means gastric juice. It is the initiator of the secretory process and digestive activity. Except in stomachical disease one probably never has the first without the second, and the second is comparatively meagre without the first. The question as to whether one should eat when one is not hungry, therefore reduces itself to the problem of cre-

[1] *Op. cit.*, p. 235.

ating an appetite. As will be seen later, all that has been said in an earlier chapter about exercise has psychological significance in this connection. Food habits also—likes and dislikes—except in certain comparatively rare instances of physiological repugnance, are primarily psychological matters, and only secondarily physiological. The meaning of this in the rearing of children is reserved for later treatment.

We have said that appetite means gastric juice, and that food without interest produces comparatively little gastric secretion. Pavlov demonstrated this by two experiments of great importance. First, he introduced bread and coagulated egg white directly into the stomach of a sleeping dog through the opening that had been made. After an hour or more not a drop of juice had appeared. A glass rod passed into the food of the stomach came out dry. Flesh excited some secretion, but its appearance was considerably retarded, and it was scant during the first hour. Besides, its digestive action was weak. In order to show that the loss of value of food without attention and desire was not caused by the fact that the animal was sleeping, Pavlov next took two dogs, both of which had been operated upon in the same way. Into the stomach of one pieces of flesh were introduced through the direct opening, while the animal's attention was diverted by patting and caressing so as to keep him from seeing the food. The same weight of pieces of meat was then put into the stomach of the second dog through the direct opening, but at the same time he was given a sham meal. In both cases the pieces of meat were attached to a string, and after an hour and a half, during which the dogs were left alone in separate rooms, the meat was withdrawn and weighed. The difference in the loss of weight through digestion was striking. In the dog without sham feeding, and consequently without interest in the process, the flesh had been reduced by only six grammes, while in the case

of the one who was given a fictitious meal when the meat was put into his stomach there was a loss of thirty grammes. The difference then, in the case of these two dogs, represents the digestive value of appetite, of the interests of the one in what he was eating, and his desire for it. It shows, in other words, the importance of the psychical factor. Pleasure in what one is eating starts and promotes the flow of gastric juice, and lack of interest delays the process, lessens the quantity when the secretion begins, and seems to reduce its digestive value. Pavlov's conclusions have been verified by Bickel and Sasaki,[1] who observed a generous flow of gastric juice in dogs while they were being given a fictitious meal. In one case when the sham feeding lasted for only five minutes the secretion continued for twenty minutes, and in that time a large quantity of pure gastric juice was collected.

Carlson emphasizes another phase of this complex psychophysiological process of digestion—a factor big with psychological meaning. It is the tonic effect of appetite upon the alimentary canal. "The significance of hunger and appetite for digestion," he says, "is apparently not so much in the actual yield of appetite gastric juice as in the fact that when these sensation-complexes are present the entire gastro-intestinal tract, both on the motor and on the secretory side is in fit condition to handle the ingested food."[2] Both factors—"psychic" juice and tonus—are evidently present in keen anticipation of interesting food, and each is greatly increased when the expectation is realized by the pleasant taste of mastication. Cannon, speaking somewhat more technically of the tonic effect, says: "Tonus as an essential factor of gastric peristalsis is first given by vagus impulses, and later maintained by the stomach itself. . . . Probably a psychic tonus is developed by the taking of food." The vagi and the splanchnics "are nerves which increase or decrease

[1] *Op. cit.* [2] *Op. cit.*, p. 247.

the tonus of gastric musculature, and thereby affect peristalsis. The absence of stomach movements, for example, in states of exhaustion, can be explained by the failure of vagus impulses; and in emotional states by the presence of splanchnic impulses. Both conditions result in absence of gastric tonus." [1]

Disturbances of one sort or another may, however, interrupt the anticipation of interesting food. In speaking of the salivary reflex, attention was called to the fact that interferences may be started and the process inhibited. The dry mouth during nervous tension was mentioned as an illustration. Inhibition has also been observed in the secretion of gastric juice. Bickel and Sasaki brought a cat into the room of one of their dogs. The animal became furious and struggled to reach it. The cat was then removed and the dog was given a sham meal. He was hungry and ate ravenously, yet little gastric juice was secreted. Twenty minutes after the meal ended only nine cubic centimetres of juice of a rather poor quality had been secreted, while Pavlov, in a calm dog, had secured from twelve to fifteen cubic centimetres of pure juice in from six to ten minutes. Bickel and Sasaki then continued the test of the effect of anger by giving their dog a sham meal, and after the gastric secretion was well started again bringing the cat into the room. As before, the dog became violently angry and struggled again at his chain. Though the secretion had been well under way for fifteen minutes, only a few drops of a poor quality of juice appeared. The effect of the previous state of excitement continued and checked the flow. Oechsler[2] has also found that the secretion of the pancreatic juice is suppressed in animals by anger. So rage checks the secretion of all the juices that are essential to the chemical changes in food

[1] *American Journal of Physiology*, vol. 29, p. 250.

[2] *Internationale Beiträge zür Pathologie und Therapie der Ernährungstörungen*, vol. 5, p. 1.

during digestion. For some time after a fit of anger digestion ceases. But violent rage is not needed to produce the inhibition. Timidity may give the same result. Le Conte found that, in dogs, fear of strange surroundings delayed the secretion of gastric juice. With his animals inhibition occurred when they were tied. After the dogs became accustomed to the restraint, however, the secretion was not disturbed.

We are now able to understand why the child upon whom Hornborg[1] experimented failed to secrete gastric juice at the sight of food. Dogs, under these circumstances, are eager to be fed and they dance around joyously. The child, on the other hand, became angry and began to cry when shown food that he was not allowed for the moment to eat. The same observation was made by Bogen.[2] One of his patients, a boy with closed œsophagus, and gastric fistula, became so angry at the sight of food which was withheld that, when he was calm and the food had been given to him, no gastric juice was secreted. It is clear then that not only are pleasurable emotions favorable to digestion, but those that are unpleasant retard the process by preventing the secretion of gastric juice. Not anger and rage alone have this effect, but also worry and anxiety. Indeed, as the investigations of Bickel and Sasaki led them to conclude, all depressing emotions delay digestion, and prevent it from being carried on with its customary vigor when once it has started. A further inference may be drawn from these investigations which greatly increases the significance of these striking results. It will be remembered that gastric secretion when well started under favorable conditions may be quickly checked and stopped by anxiety or anger. Clearly, then, emotional influences unfavorable to digestion are stronger than those that promote it.

[1] *Op. cit.*

[2] H. Bogen, *Archiv für d. gesamte Physiologie*, vol. 117, p. 156.

All of these facts are immensely important in the psychology of daily life, yet they do not close the story. To insure proper digestion the food must be carried along through the alimentary canal so as to be acted upon by the digestive juices in different parts of the canal, and be exposed to a wide area of the intestinal wall for absorption. It was while studying these mechanical aspects of digestion, says Cannon,[1] that "I was led to infer that just as there is a psychic secretion, so likewise there is probably a psychic tone or psychic contraction of the gastro-intestinal muscles as a result of taking food." Investigations have sustained Cannon's conjecture.

When a cat becomes infuriated, in addition to the external manifestations of rage, "the activities of the stomach and intestines are stopped."[2] Cannon found that the same changes occur under similar conditions in dogs, rabbits, and guinea-pigs.[3] Fear and distress in the cat had the same effect as rage, stopping all movements in both the large and small intestines.[4] But violent excitement is not needed to inhibit the movements. Auer[5] observed that the handling required to tie rabbits to the board, however gentle the experimenter may strive to be, stops peristalsis for a variable length of time. The movements shortly appear again. "But if the animal be startled in any way, or if it struggles, motion is again abolished for some time." Cannon watched the stomach of a vigorous young male cat for more than an hour, and "during that time not the slightest beginning of peristaltic activity appeared; yet the only visible indication of excitement in the animal was a continued quick twitching of the tail to and fro."[6]

[1] Walter B. Cannon, *Bodily Changes in Pain, Hunger, Fear, and Rage*, 1915, p. 13.
[2] Walter B. Cannon, Address at Johns Hopkins University, April 17, 1916.
[3] *Op. cit.*, p. 15.
[4] Walter B. Cannon, *American Journal of Physiology*, vol. 6, p. 251.
[5] John Auer, *American Journal of Physiology*, vol. 18, p. 347.
[6] *Op. cit.*, p. 15.

Lommel [1] observed the same effect of slight degrees of excitement. He noticed that small dogs placed in strange surroundings frequently showed no contractions of the stomach for two hours or more. "Like the peristaltic waves in the stomach, the peristalsis and the kneading movements" [segmentation] "in the small intestine, and the reversed peristalsis in the large intestine, all cease whenever the animal shows signs of emotional excitement." [2] Auer found that irritating odors also produce temporary inhibition of gastric motility. Esselmont[3] likewise concludes that many emotional states stimulate peristalsis, and that other emotional conditions inhibit the movements; and Roosbach[4] has established the stoppage of intestinal peristalsis in man from the same causes as those that produce it in the lower animals. Finally, Fisher and Fisk sum up[5] the more recent investigations by saying that "the X-ray has detected the arrest of the peristaltic movements of the stomach and intestines because of a strong emotion." And "some peculiarly constituted persons," they add, "who take their work and obligations with a kind of seriousness that amounts almost to fear, cannot eat anything of consequence until their day's work is ended. The digestive processes seem to be at a standstill until then."

Appetite is thus seen to have a wide physiological reach. It touches digestion at various points. Among them all, however, it should be emphasized that the "psychic" juice *starts* digestion, and the significance of this in promoting the continuance of the process cannot be overestimated. With meat, as Pavlov found, because of the pleasure which this food affords dogs, the "psychic" juice initiates rapid digestion which is afterward aided by the

[1] Felix Lommel, *Münchener medizinische Wochenschrift*, 1903, 2, p. 1634.
[2] Cannon, *op. cit.*, p. 16.
[3] *Report of the British Association for the Advancement of Science*, 1899, p. 899.
[4] *Deutsches Archiv für klinische Medizin*, vol. 46, p. 323.
[5] *How to Live*, p. 110.

further secretion caused by this first excitant. The stay of food in the digestive canal is thus shortened. With certain other foods the "psychic" juice seems even more indispensable. "Bread or egg white eaten without appetite, or introduced into the stomach unobserved, will lie there for a long time without the least appearance of change. In such cases the appetite juice is the sole initiator of the digestive process. When started by its assistance, the digestion of these foods proceeds spontaneously. The 'psychic' juice here plays a similar rôle to that of the igniting material which sets the fuel in the stove ablaze, and for this reason it has been called by Khizbin 'igniting juice.'" [1]

Starling, estimating the conclusions of Pavlov and others, and bringing them into connection with the physiological processes, summarizes the results for physiology as follows: The normal gastric secretion is "due to the co-operation of two factors. The first and most important is the nervous secretion, determined through the vagus nerves by stimulation of the mucous membrane of the mouth, or by the arousing of appetite in the higher parts of the brain. The second factor, which provides for the continued secretion of gastric juice long after the mental effects of a meal have disappeared, is chemical, and depends on the production in the pyloric mucous membrane of a specific substance or hormone, which acts as a chemical messenger to all parts of the stomach, being absorbed into the blood, and thence exciting the activity of the various secreting cells in the gastric glands. . . . The juice secreted in the second phase must vary according to the quantity of gastric hormone produced in the pyloric mucous membrane, and therefore with the nature and amount of substances produced in the preliminary digestion of the gastric contents by means of the psychic juice." [2]

[1] Pavlov, *op. cit.*, p. 125.

[2] Ernest H. Starling, *Human Physiology*, 1915, pp. 695 *ff.*

It is clear then that digestion is not merely physiological. The process is very complex and includes psychic factors which precede and initiate the physiological action. Simply taking food—even the right food—does not fulfil the requirements of nutrition. Successful eating is both a science and an art. The science consists in determining the suitable dietary in a given case. This is the physician's task. The art lies in planning conditions that shall promote the physiological processes favorable to digestion. These conditions are devices to produce the anticipatory mental states which start the "psychic" juice and this planning is primarily the function of the home-keeper, and of men and women in their personal arrangements. Efficiency means first of all efficient living, and intelligence requires conservation of all the factors that contribute to health; and, among these, digestion is not second. Henry Ward Beecher's epigrammatic cry that dyspeptics cannot enter the Kingdom of Heaven was not a joke. There are many other high places this side of Heaven from which they are barred. For health and happiness, adjustment of one's personal life to the facts disclosed by these experiments is imperative; and to this discussion we now turn.

In interpreting these investigations for guidance in the psychology of life the first thought likely to come to the amateur thinker is that he should eat only what he wants. This would naturally lead to the elimination of the less palatable and, in many cases, the more substantial foods. Foods, however, have different nutritive value. Some are worth eating for what they give us, and others are designed to furnish an agreeable end to the meal. Desserts have immense importance in the psychology of eating. There is no doubt that they increase and prolong the secretion of gastric juice; but they are not the nutritive foods, and the latter are the things that would often be omitted by choice if one consulted only the vagaries of taste. But they are also the foods that the body needs. Consequently, the

first dietary problem for an adult, after being advised by a skilled physician, is to create an appetite rather than to humor it.

Here then is seen the further significance for appetite, and consequently for digestion, of exercise in the open air. Exercise purifies the blood by increasing the intake of oxygen and the output of carbon dioxide. It quickens and improves metabolism by a more rapid circulation of blood and an increase of the oxygen supply. Many more persons than are commonly supposed suffer from intestinal intoxication—the accumulation of toxic products from undigested food. In its milder forms this causes lassitude and headaches. Exercise in the open air tends to eliminate these toxic products through the various excretory organs, and the more rapid circulation of the blood aids this elimination and promotes a vigorous metabolism. Much of the value of osteopathy and massage consists in giving passive exercise to the organs and muscles of the body. Those who are too indolent to exercise their own body, pay to have it exercised.

"Eat what you want to eat" depends upon what you want. After one has produced a vigorous appetite this advice regarding eating, when given by an intelligent physician, is good; but for the anæmic, headachy, toxæmic man or woman the first admonition should be: "Play tennis or golf, ride horseback, or walk five miles a day, and then eat what you want." Having taken exercise in the open, the body will demand substantial food and the appetite will crave it. The sight and smell of roast beef with vegetables will then be more enticing and therefore produce more "psychic" juice than the most delicate meringue air-bubbles.

Training in childhood evidently plays an important rôle in producing likes and dislikes for food. Barring physiological repugnance, which is far less common than is usually thought, likes and dislikes are due altogether to

early environment and training. Every nation has its peculiarities in eating. It is not necessary to refer to the insects eaten by certain primitive peoples whose diet is abhorrent to civilized races. Some of the choicest delicacies of the modern epicure, as frogs' legs, caviare, eels, and calves' brains are abhorrent to sight and taste before the liking has been acquired. The foods that shall appeal to the man and woman, and excite the salivary and gastric reflexes so as to prepare the way for vigorous and healthy digestion are decided in the homes of boys and girls whose mothers are often more mindful of the moment's indolent ease than of the future welfare of their children.

Regularity in meals is advocated because the digestive organs need rest. This is surely important, but there is also a psychological argument in its favor that has a bearing upon the secretory activity of which we have been speaking. When meals are served at definite hours, the thoughts naturally turn to eating when the time arrives. This prepares the salivary and gastric reflexes for stimulation. Saliva may even be secreted at the thought of the hour. If one observes oneself at such a time one will often find the mouth watering. This is especially the case when one anticipates something pleasant to the taste. For this reason it is important that business and professional men have pleasant places in which to lunch, and that women in the home have the table prepared and luncheon served in quite as interesting a way as if they were to have guests. A noisy restaurant, which a man does not anticipate entering and in which the surroundings are disagreeable, defeats the first purpose of taking food, which is to excite the digestive reflexes, and by defeating the first it greatly weakens the second—the continued production of gastric juice. For the "psychic" juice is the "igniting juice." Women, again, who eat a "picked-up lunch" are in much the same position as the dogs into whose stomachs food

was introduced through the gastric fistula. The absence of attention and interest in the dogs prevented the secretion of gastric juice, and the food remained long undigested. Probably here also lies the explanation of loss of appetite in some women who do their own housework. The long-delayed anticipation and the continued odor of the food fatigues and dulls the taste-secretory mechanism, so that when the meal is served it fails to start the "psychic" flow of the salivary and gastric juices, which are the beginning of appetite. The knowledge of what is to be served also has the same effect. We are accustomed to speak of higher and lower thoughts, but these are relative terms having reference to the value of their content, and the psychology of digestion shows that eating without previous pleasurable thoughts of the meal defeats its end. The important thing is that the anticipation be "normal" and find its gratification in well-prepared, wholesome foods.

On the other hand, the vulgar rich—those who display their wealth in sensuous indulgence—who are continually seeking some gastronomic novelty soon lose pleasure in foods they should enjoy. The sensitiveness of their digestive reflexes is dulled. Satiated by superfluity and novelty they are like the children in such families to whom the usual toys at Christmas bring no joy. Excess has blunted the sensations that should arouse agreeable feelings. Their tastes and emotions are diseased. They are pathological gastronomists.

The conditions of modern life produce much the same effect in other ways. The sedentary life of business and professional men in the strain of the world's work lowers the physical vitality and raises the threshold of appetite. So the taste must be tempted. Not, however, so much with unusual foods as with delicacy and attractiveness in the manner of serving. This is the explanation of the importance of the grade of the luncheon restaurant. It is well known that excellent quality of food and cooking fails

to tempt if the service be not neat. Pleasant conversation with choice friends adds to the zest. In part, it is the psychological principle of the summation of stimuli. Many agreeable sensations working together have more value in brightening the emotions than their sum when applied separately. The psychology of the crowd also plays its rôle; and a few congenial friends in animated conversation always make a psychological crowd. Appetite, like ideas, is then contagious.

Heated discussions, however, should be avoided. Even though anger does not arise, the tension of too serious discussion tends to inhibit the reflexes and check the secretion of gastric juice. Investigations have shown that moderate excitement of a disagreeable tone quickly reacts upon the bodily activities. In digestion the effect is probably produced by draining off nervous impulses through the excessive activity of higher brain-centres, and partly, again, by setting up interferences. In any case, a too active mind starts resistance to the action of lower reflexes that in their very nature are sensitive to obstructions. This is the psychological reason for the abolition of "shop talk" at meals. One's business is too serious for table talk. The conversation should be in lighter vein. Naturally, the subjects should be those in which the group is interested, but the interest should be of the amateurish sort, without the excitement of fixed convictions. On this account the associates should be selected with some thought. Social likes and dislikes will take care of this, but there should be agreement upon the place and hour. It would be well if business and professional men would arrange their luncheon groups with much the same thought as they plan a dinner, taking care that the members be congenial. Time enough should be allowed to avoid the feeling of hurry, for hurry, like worry, is inhibiting in its effect. A fifteen-minute luncheon is a business blunder as well as a psychological error. Business efficiency consists in taking

account of all the factors that enter into the result, and digestion is certainly one of these factors.

The importance of appetite for digestion shows that cafeterias are psychological monstrosities. Their popularity springs from the mistaken notion that minutes are all that count in business efficiency, and from the belief that cheapness is altogether a matter of dollars and cents. Efficiency depends more upon one's physical condition than upon anything else, and some things are expensive at any price. We have seen that putting food into the stomach does not necessarily mean digestion and nourishment. Those who eat in cafeterias might as well stay in their offices and be fed through gastric fistulæ. They would save more time. Conversation with those who lunch in these eating shops has almost invariably brought the same reply. They eat much the same things each day, hurry through so as to get back to business, and gradually lose their appetite. Because of loss of appetite they limit themselves to the lighter, more appetizing, and frequently less digestible foods, and coffee. The doctor usually gets the money they save by this economy, and their shortened life is heavy interest on the accumulated minutes which they deposit to the credit of business. In these places there is no incentive to keep the mind from the work one has just left. Indeed, men often go across the street to a cafeteria that they may think about some matter which is troubling them. The atmosphere of these places is hurry. At the noon-hour they are crowded, and some one is waiting for a vacant seat. Bustle begets nervousness, and the pastry is swallowed with a gulp of coffee. This is feeding but it is not eating.

Some things not usually thought of in connection with appetite are important in starting the "psychic" flow. The stage should be set to create both the bodily feeling and suggestion of pleasure. The psychological effect of change of clothing is an illustration; and in America this

is too largely overlooked. The business or professional man comes home tired. He makes only the toilet that cleanliness requires, and sits down to dinner. Change in raiment is always refreshing. The smoothness of the dinner clothes seems to iron out some of the business wrinkles of the body. Business is attached to garments just as it is connected with the office. Change is, of course, the important psychological factor here. The clothes may be no better than those that were removed, but they are different, and that produces a different feeling. Feelings seem to be quite as much a matter of clothes as of mind. The friction on the body is altered, and it is well known that even slight relief from friction is refreshing. The relief that comes with change of shoes when one is fatigued from walking is a matter of common knowledge. This is true even when the shoes do not fit so well as those removed. Besides, one sees oneself differently. The clothes look fresher merely because one has not seen them during the day. Familiarity breeds contempt in more ways than one. If it is not exactly contempt in the present instance it is, at any rate, the familiarity of prolonged association that makes common, and, psychologically, this has much the same effect. The writer has often observed, when camping, that change to an equally disreputable suit freshens body and mind. Change of any sort usually causes some alteration in the feelings and attitude of the individual affected. And removal of business clothes rids one of many thoughts and worries associated with them. All of this puts one into condition to be pleasantly affected by the sight and odor of food, and the digestive reflexes respond more readily to the psychic influence.

The influence of change on digestion is still more noticeable when the environment is altered. Vacations, even short ones, are good digestive and business propositions. Vacations are abhorrent to some merely because they require change of habits. But that is the reason for

taking them. A physiological jolt benefits the organs and improves digestion. It has been observed that sometimes at a banquet one can eat vastly more than the stomach would take care of under routine conditions; and, when the experience is not repeated too frequently, one awakens the following morning mightily refreshed. Probably this is due to stomachical tonus chiefly of psychological origin. Habits are stultifying. Routine kills. If it does not kill the body it blunts its sensory edge. Response to stimulation, both internal and external, is slower and less efficient; and it kills the mind. The distinction from bodily death is that he who is mentally dead thinks that he is alive. A man who never, or rarely, takes a vacation does things mechanically, goes to his office mechanically, does the "next thing" mechanically, and his digestion works mechanically. The writer once saw a motto on a business man's desk which read, "Do the next thing." Now one who does "the next thing" never gets anywhere. There is no selection, no discrimination of values. A startling change in environment, with its necessary alteration of habits, throws one out of gear for the moment. That is its value, both bodily and mentally. The things that one has been doing are no longer a part of oneself because one can no longer do them. So a man is able to view them objectively. He has a better perspective. He sees proportions more clearly. The worries of business are not as troublesome since he sees that some of the matters are not so important as he thought when he stood facing them. Their magnitude diminishes with distance. Other things settle themselves; and this mental composure reacts beneficially upon digestion.

Change of scene animates the mind by relieving it of the weariness of "the same old things"; and the mental refreshment puts one into condition to anticipate one's meals. Later, on returning, the old takes on a new look, and the man begins his work with a more alert judgment

because his metabolism is improved. James once shocked certain Puritanic, naïve people, devoid of humor, by saying that change is so important that even a spree has its value. Any break in routine is refreshing, and the sharper the break the better. And quickening the bodily activities arouses the appetite and promotes digestion. Indigestion is sometimes an organic habit produced in part by the monotony of sameness.

So we see that the mental state is of immense importance in the digestive process. An active attitude of anticipation produces both psychological and physiological results. It causes a greater preliminary flow of "psychic" juice, and, in addition, has a tonic effect upon the whole digestive tract, creating a tonus that promotes the proper treatment of the food. The psychical factor yields readily to control; and an active, healthy mind, whether the result of determination to be pleasant or of the bodily care that improves the "feelings," promotes a vigorous metabolism. This gives a keen appetite; and here the significance of outdoor exercise, with occasional change of environment, becomes apparent.

Digestion, then, is a marvellously sensitive process. Its delicacy is not noticed during the vigor of youth by those who lead a free, active life in the open air. But in years of maturity few are unaware of the frailty of the machinery by which food is changed into the energy that produces the day's work. Clearly, digestion plays a prominent rôle in the drama of life. Mind and body are not totally separate and different. They function together and derangement of one exerts a powerful influence upon the other, whatever philosophical difficulties may arise in defining this relationship. In determining our reconstruction of the conditions to which we will adapt ourselves, in our thinking and acting, in the habits that we form, in the onslaught of fatigue, and even in the selection of the "self" that is to control our lives, digestion is never a silent partner.

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